UNITED STATES AIR FORCE
SCHOOL OF AEROSPACE
MEDICINE

Bioenvironmental Engineering Guide to Toxic Industrial Chemical/Toxic Industrial Material (TIC/TIM) Vulnerability Assessment

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SUMMARY OF CHANGES

This guide replaces the Bioenvironmental Engineering Guide to Toxic Industrial Chemical/Toxic Industrial Material (TIC/TIM) Vulnerability Assessment, July 2009 (Updated September 2011). Content has been extensively reorganized and updated.

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ABOUT THIS GUIDE

The Bioenvironmental Engineering (BE) Guide to Toxic Industrial Chemical/Toxic Industrial Material (TIC/TIM) Vulnerability Assessment (VA) provides BE flights or elements at each installation with a suggested method for identifying and assessing vulnerabilities associated with TIC/TIM on or near the installation. The TIC/TIM VA methodology is consistent with Air Force Instruction (AFI) 90-802, *Risk Management*, which provides an overarching framework for Air Force Risk Management (AF RM).

The TIC/TIM VA methodology applies to industrial substances that may negatively affect base populations either through contamination of the air or through radioactive exposures. This methodology addresses chemicals from a toxicity perspective and not from a physical hazard perspective. TIC/TIM exposures through other means, such as food and water contamination and explosions, are outside the scope of this methodology, as other Air Force (AF) organizations conduct such assessments.

The methodology entails conducting a high-level analysis of TIC/TIM to estimate relative risks to the installation using simplifying assumptions and approaches. This methodology allows BE to use the information detailed in this guide (e.g., chemical, chemical quantity, toxicity, vapor pressure, environmental conditions, distance of the source from the installation), along with experience and professional judgment, to determine the risk level for each possible release scenario.

Use this guide to prepare a TIC/TIM VA in advance of an event to identify substances that have the potential to affect the installation. Do not use the TIC/TIM VA as a reference in the event of a TIC/TIM release or incident. Do use the assessment results in subsequent planning activities to determine if (and ensure that) the installation has the capability to detect, respond to, and defend against these substances. Results from the TIC/TIM VA methodology will allow BE to determine the best way to perform subsequent health risk analysis. However, do not use the guide for inspection criteria.

This guide provides one of many appropriate TIC/TIM VA methodologies. There is no single best way to assess the hazards identified during the TIC/TIM VA. BE should conduct a complete assessment, i.e., using the data received from all sources, and document data for all TIC/TIM of concern (i.e., those posing an acute health hazard).

In the past, BE has used plume modeling to assess the hazards associated with the release of a TIC/TIM. BE is not required to perform plume modeling as a part of the TIC/TIM VA. However, modeling can be a very useful tool for assessing whether or not a contaminant source has the potential to affect an installation. For additional assistance with plume modeling, BE may access resources such as United States Air Force School of Aerospace Medicine (USAFSAM) personnel, Civil Engineering (CE)

Emergency Management (EM) personnel, or Defense Threat Reduction Agency (DTRA) Reachback Center for Hazard Prediction and Assessment Capability (HPAC).

The layout of the guide supports execution of an assessment. The first two sections provide an overview and background on the TIC/TIM VA methodology. The third section provides additional detail on potential classification requirements to meet when conducting an assessment. Sections four (4) through seven (7) describe execution of the methodology, to include: pre-assessment activities (Phase I), information gathering (Phase II), information processing activities (Phase III), and developing the TIC/TIM VA report (Phase IV). The final two sections contain a list of references and a glossary of terms used within the Guide. There is also a list of acronyms and abbreviations.

The remaining Appendices provide additional information and tools used in execution of the assessment. Appendix A: Classified Material Requirements provides specific guidance with respect to the classification of elements of the assessment, labeling of documents, and the disclosure of information. Appendix B: Overseas TIC/TIM Data Collection provides resources for personnel conducting TIC/TIM VAs at overseas locations. Appendix C: Levels Of Concern (LOC) for toxic chemicals describes the hierarchical ranking of risk values based on the effects of chemicals on individuals used in the TIC/TIM VA methodology. Appendix D: RMP*Comp contains instruction for the use of an online planning tool developed by the National Oceanic and Atmospheric Administration (NOAA) and the Environmental Protection Agency (EPA) to help facilities identify high priority hazards located at their facilities. Appendix E: TIC/TIM Vulnerability Assessment Workbook is a user workbook to support the implementation of the assessment. The workbook, which is available from USAFSAM/OEC, Consultant Division, includes blank forms, worksheets, and instructions for assessors.

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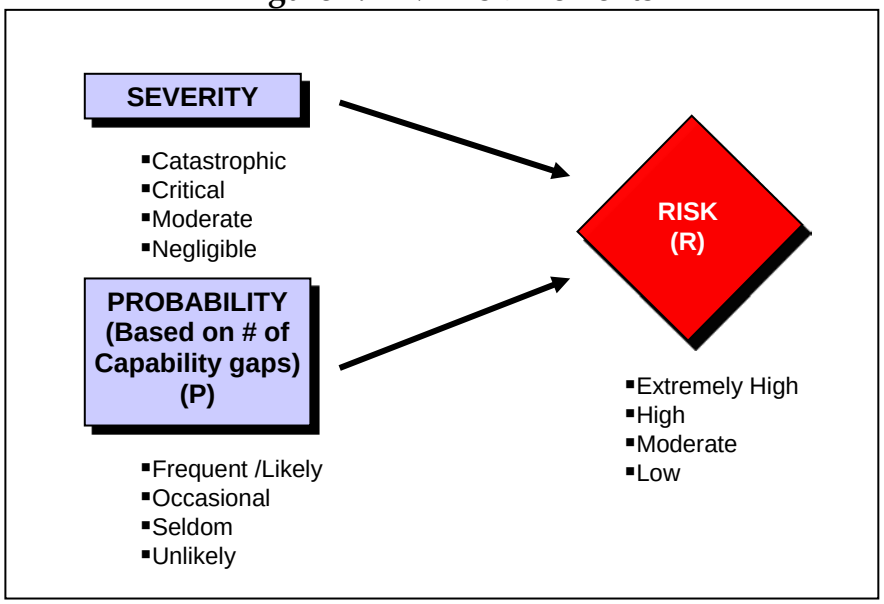
1. INTRODUCTION: OVERVIEW OF THE METHODOLOGY

This BE Guide to TIC/TIM VA methodology is consistent with Air Force Instruction (AFI) 90-802, *Risk Management*, which provides an overarching framework for Air Force Risk Management (RM). AFI 90-802 also establishes the requirement to integrate and sustain RM throughout the AF as a risk reduction process to assist leaders in identifying and controlling safety and health hazards and make informed decisions. Air Force Pamphlet (AFPAM) 90-803, *Risk Management (RM) Guidelines and Tools* details how to implement RM principals. The diagram below shows the major elements of risk and the corresponding RM.

Figure 1. RM Risk Elements



This guide outlines the collection and evaluation of accurate and detailed information regarding the following major components:

- Prepare an inventory of TIC/TIM on and surrounding the installation.
- Characterize the threats posed to the installation by the identified TIC/TIM.
- Determine the potential severity of toxic releases and radioactive exposures.
- Determine the risk and ranking of exposure scenarios.
- Identify vulnerabilities (gaps or deficiencies) in the installations' detection, defense, and training capabilities.

1.1 Key Terms and Definitions

- Joint Publication (JP 3-11, 2013) *Operations in Chemical, Biological, Radiological and Nuclear Environments* defines **Toxic Industrial Materials (TIM)** as "*toxic, chemical,*

biological, or radioactive substances in solid, liquid, aerosolized, or gaseous form that may be used, or stored for use, for industrial, commercial, medical, military, or domestic purposes."

- JP 3-11 defines **Toxic Industrial Chemicals (TIC)** as "*a chemical developed or manufactured for use in industrial operations or research by industry, government, or academia that poses a hazard."*

- JP 3-11 defines **Toxic Industrial Biologicals (TIB)** as "*any biological material manufactured, used, transported, or stored by industrial, medical, or commercial processes which could pose an infectious or toxic threat."*

- JP 3-11 defines **Toxic Industrial Radiologicals (TIR)** as "*any radiological material manufactured, used, transported, or stored by industrial, medical, or commercial processes."*

1.2 TIC/TIM Subject to the Methodology

The methodology applies to evaluating a majority, but not all, of air contaminants. TICs evaluated in this methodology include toxic gases and toxic liquids that appear on the Environmental Protection Agencies (EPA's) Risk Management Plan (RMP) list. Due to the imprecise nature of TIB, they should be included in the inventory but not evaluated. Inventory and evaluate gamma-emitting TIR. Alpha-emitting and beta-emitting TIR should be included in the inventory but not evaluated. Do not inventory or evaluate nuclear fuel or weapons-grade material, since they fall under the purview of the Department of Energy (DOE).

2. BACKGROUND

Air Force Instruction (AFI) 10-245 *Antiterrorism (AT)* assigns the Medical Group (MDG) as the installation lead for conducting annual TIC/TIM and Food/Water VAs. Requirements include:

- Enter vulnerabilities and observations in Core Vulnerability Assessment Management Program (CVAMP) within 90 days of the signed assessment report.
- Monitor, track and manage these vulnerabilities until resolved by mitigation or installation commander's documented acceptance of risk.
- Format assessment reports for entry into CVAMP.
- Ensure local assessments per Air Force Manual (AFMAN) 10-246, *Food and Water Protection Program* are consolidated and conducted at the same time as the local AT Vulnerability Assessment.

2.1 Purpose

The purpose of this guide is to provide a suggested methodology for evaluating risks associated with TIC/TIM on or near AF bases, consistent with AFI 10-245 and AFI 10-2501, *Air Force Emergency Management (EM) Program Planning and Operations*.

2.2 Scope

The TIC/TIM VA methodology considers industrial substances that may negatively affect base populations through contamination of the air or radioactive exposures. TIC/TIM may cause harm by other means, including food and water contamination and explosions. The AF assesses these types of events elsewhere and, thus, these events are outside the scope of this methodology. BE can evaluate a majority of air contaminants using the approach outlined in this guide, but there will be exceptions. BE should conduct as complete an assessment as possible and document data for all TIC/TIM of concern (i.e., those posing an acute health hazard).

2.3 Authority and Responsibilities

AFI 10-2501 assigns BE the following responsibilities:

- Collecting information on Occupational and Environmental Health (OEH) hazards with the potential for causing incidents requiring emergency response within the theater, local area, and installation.
- Evaluating relative OEH risks related to potential operating locations to assist in the site selection process and minimize the risk of incidents requiring emergency response.

- Executing Surgeon General (SG) vulnerability assessments (such as water or TIC/TIM) with the support of other functional experts and recommend prioritized measures to the Antiterrorism Working Group to reduce risk through vulnerability reduction or consequence reduction.

2.4 Technical Support

For answers to questions or for other assistance, contact the USAFSAM Environmental Safety and Occupational Health (ESOH) Service Center.

ESOH Service Center website:
https://hpws.afrl.af.mil/dhp/OE/ESOHSC/
DSN: 798-3764 or 1-888-232-3764
Email: esoh.service.center@wpafb.af.mil

BE is not required to perform plume modeling, but may contact the Defense Threat Reduction Agency (DTRA) Joint Operations Center for model predictions in support of peacetime response or recovery from a catastrophic Chemical, Biological, Radiological, and Nuclear (CBRN) event. The Joint Operations Center will be equipped with Joint Effects Modeling, digitized mapping software, and be able to send and receive inputs, reports and other communication from the Emergency Operations Center (EOC), unit control centers, and specialized teams.

Website: https://opscenter.dtra.mil/
Commercial: 1-(877) 240-1187 or (703) 767-2000 **DSN:** 427-2000 or 427-2003
Unclassified Fax: (703) 767-2094 **Classified Fax:** (703) 767-2085
Unclassified Email: opscntr1@dtra.mil
Classified Email: opscntr1@dtra.smil.mil

3. CLASSIFICATION REQUIREMENTS

It is important to include the Antiterrorism Officer (ATO)/Installation Security Manager in the TIC/TIM VA process from the beginning in order to ensure proper handling and classification of the documents produced during the TIC/TIM VA process.

3.1 Key References

Classify vulnerabilities according to Air Force Instruction (AFI) 10-245, *Antiterrorism (AT)*, and Department of Defense Instruction (DoDI) 2000.16, *DoD Antiterrorism (AT) Standards*, and AT/Force Protection (FP) in accordance with the DTRA *Security Classification Guide for Vulnerability Assessments* (SCG).

- Classify any portion of a document where a vulnerability or a concern is associated with a specific U.S. military site as CONFIDENTIAL (C) or SECRET (S).
- Classify portions of documents where vulnerabilities have been identified but are not associated with a specific U.S. military site identified in the same report as FOR OFFICIAL USE ONLY (FOUO).
- Portions of documents not identifying specific Antiterrorism/Force Protection AT/FP vulnerabilities, but containing information that, if released to the public, could be exploited (e.g., facility data, TIC/TIM inventory, TIC/TIM location map) will be marked FOUO.
- Sections or paragraphs containing solely unclassified information should be marked UNCLASSIFIED (U). Follow the same procedures for briefings.

The overall TIC/TIM VA report must be marked SECRET using the latest guidance.

3.2 Classification Instructions and Requirements

For in-depth instructions and requirements related to Classification of the TIC/TIM VA, see Appendix A.

4. PHASE I: PRE-ASSESSMENT ACTIVITIES

Plan and coordinate activities to complete the assessment efficiently and according to schedule. The following sections describe the major steps involved in the planning and coordination of the assessment.

4.1 Identify Lead Assessor

Identify a lead assessor that will manage the assessment team and perform overall coordination. The lead assessor assigns tasks associated with all phases and ensures that the team completes the assessment according to schedule.

4.2 Identify Team and Assign Roles and Responsibilities

The lead assessor will identify a multi-disciplinary team to assist in the completion of the assessment. The lead assessor should make a reasonable effort to include a diverse array of experts that are collectively capable of performing the detailed steps within this guidance. The importance of the expertise and composition of the assessment team cannot be understated.

Team members should have strong technical backgrounds and familiarity with the following:

- TIC/TIM VA methodology
- Site-specific TIC/TIM, installation infrastructure, base operations, and off-base industries
- TIC/TIM characteristics and health effects
- Transport of contaminants via air

4.3 Develop List of Stakeholders

Identify individuals from various organizations that can support data collection requests. These organizations/individuals may include, but are not limited to, the following:

- Bioenvironmental Engineering (BE)
- Radiation Safety Officer (RSO)
- Antiterrorism Officer (ATO)
- Office of Special Investigations (OSI)/Intel
- Security Forces (SF)
- Civil Engineering (CE)
    - Emergency Management (EM)

  - Local Emergency Planning Committee (LEPC) representative
  - Environmental Manager - Emergency Planning and Community Right-to-know Act (EPCRA) point-of-contact (POC)
  - Fire Department
  - Pest Management
  - GeoBase POC
  - Hazardous Waste Program Manager
  - Real Property Officer
- Hazardous Material Pharmacy Manager
- Safety Office
- Weather Office
- Public Health
- Contractor Support
- Off-Base LEPC Representative(s)
- Off-Base State Emergency Response Committee (SERC) Representative(s)
- Railroad Company Environmental Safety Officer(s)

Use Form 1-1, found in the TIC/TIM VA Workbook (Appendix D), to document the POC from each of these organizations.

5. PHASE II: INFORMATION GATHERING

The next step in conducting a TIC/TIM VA is to identify all TIC/TIM located within a threshold radius of the AF installation. The EPA's RMP Rule, which implements Section 112(r) of the 1990 Clean Air Act amendments, requires facilities to perform off-site consequence analysis. AFMAN 48-154, *Occupational and Environmental Health Site Assessment* (OEHSA), Section 3.4, recommends a 20-mile radius when evaluating potential hazardous facilities as part of an OEHSA. EPA tools model distances to endpoints for toxic substances up to 25 miles (e.g., for anhydrous ammonia and hydrogen fluoride), although EPA reminds readers that the larger distances (more than six to ten miles) are very uncertain (US EPA, 1999).

JP 3-11 (2013) defines the categories of TIC/TIM to inventory and evaluate as follows:

- **Toxic Industrial Materials (TIM)** - "*toxic, chemical, biological, or radioactive substances in solid, liquid, aerosolized, or gaseous form that may be used, or stored for use, for industrial, commercial, medical, military, or domestic purposes.*"

- **Toxic Industrial Chemicals (TIC)** - "*a chemical developed or manufactured for use in industrial operations or research by industry, government, or academia that poses a hazard.*" TIC evaluated in this methodology include toxic gases and volatile toxic liquids that appear on the EPA's RMP list. The TIC/TIM VA methodology is not intended to inventory or evaluate chemical compounds that are flammable or explosive, but have little or no acute toxicity (e.g., propane, butane, natural gas, isopropyl alcohol, ethyl alcohol, petroleum distillates, diesel, gasoline, and jet fuel). This methodology only addresses chemicals from a toxicity perspective and not from a physical hazard perspective.

- **Toxic Industrial Biologicals (TIB)** - "*any biological material manufactured, used, transported, or stored by industrial, medical, or commercial processes which could pose an infectious or toxic threat.*" Due to the imprecise nature of TIB, include TIB in inventory but do not evaluate them.

- **Toxic Industrial Radiologicals (TIR)** - "*any radiological material manufactured, used, transported, or stored by industrial, medical, or commercial processes.*" Inventory and evaluate gamma-emitting TIR. Alpha-emitting and beta-emitting TIR should be included in the inventory but not evaluated. Do not inventory or evaluate nuclear fuel or weapons-grade material, since they fall under the purview of the DOE.

The following are detailed suggestions on collection of data to conduct a TIC/TIM VA at a stateside location. Appendix B describes collection procedures for non-US

locations. This section outlines data elements of the final product, a base map, and then subsequently describes methods to develop data elements.

5.1 Develop a Base Map

The assessment team should create a map of the installation that includes a minimum of a 20-mile radius around the base. The map should include the entire extent of the area of concern and infrastructure relevant to the evaluation of TIC/TIM releases. Assessors can create this map using a Geographic Information System (GIS) map/imagery tool such as Google Earth™. The following data elements should be included on the map:

- TIC/TIM identifiers and locations
- Base facilities and critical assets
- Transportation assets, including roads, railroads, ports (if applicable) and base access points

5.2 Identify TIC/TIM of Concern

No single list identifies specific and comprehensive requirements to evaluate TIC/TIM of concern. The following sections provide basic recommendations on how to identify TIC/TIM in the area surrounding the installation. It is important to emphasize that the following list includes minimum recommendations for potential chemicals and materials of concern, and that assessors may include additional items at their discretion (for example, additional chemicals/materials addressed in each state's emergency response regulations).

5.2.1 TIC of Concern

At a minimum, evaluate toxic substances regulated under the EPA RMP program.

The EPA's RMP program regulates hazardous materials under 40 Code of Federal Regulations (CFR) 68, *Chemical Accident Prevention Provisions*. Under this program, facilities that produce, handle, process, distribute, or store more than a threshold quantity of a listed regulated substance in a process, must implement a risk management program and submit a single RMP for all covered processes at the facility. Title 40 CFR 68.130 lists the RMP-regulated substances and divides them into two categories:

1) Toxic substances (listed in Table 1 of 40 CFR 68.130)
2) Flammable substances (listed in Table 2 of 40 CFR 68.130)

5.2.2 TIB of Concern

At a minimum, TIB of concern should include those substances regulated by the Department of Health and Human Services (HHS) as HHS Select Agents and Toxins and Overlap Select Agents and Toxins.

- The HHS Secretary defines Select Agents and Toxins as biological agents and toxins that "*have the potential to pose a severe threat to public health and safety.*" Title 42 CFR 73.3 lists HHS select agents and toxins.

- The HHS Secretary defines as Overlap Select Agents and Toxins as biological agents and toxins that *"have the potential to pose a severe threat to public health and safety, to animal health, or to animal products."* Title 42 CFR 73.4 lists overlap select agents and toxins.

5.2.3 TIR of Concern

TIR of concern should include, at minimum, those radiological materials that the Nuclear Regulatory Commission (NRC) regulates as Nationally Tracked Sources that equal or exceed Category 2 quantity (activity) thresholds. Appendix E of 10 CFR 20 lists the nationally tracked sources and their corresponding Category 2 threshold levels (in units of terabecquerels (TBq) and Curies (Ci)).

5.3 Collect TIC/TIM Data

Numerous sources are available for collecting data needed to accomplish a TIC/TIM VA. The specific sources used will depend on whether the TIC/TIM of concern is off-base, transportation-related, or on-base.

5.3.1 Collect Off-Base TIC/TIM Data

The following sections describe the procedures to collect off-base TIC/TIM data. The procedures will vary depending on whether the material is a TIC, TIB, or TIR.

5.3.1.1 Off-Base TIC

Assessors may obtain inventory data for TIC located off-base from three main sources:

1) the EPA RMP database
2) Emergency Planning and Community Right-To-Know Act (EPCRA) Tier II data
3) the EPA Toxic Release Inventory (TRI)

Although TIC data sources are not limited to these three, these sources provide a comprehensive initial list of TIC facilities for conducting a TIC/TIM VA.

EPA RMP Database

Under Section 112(r) of the Clean Air Act, facilities that have regulated RMP chemicals above specific quantity thresholds are required to submit an RMP. An RMP for a facility will identify the facility and the RMP-regulated chemical(s) it has onsite (i.e., location, address, contact information, chemical name, quantity of chemical stored, etc.).

The EPA keeps a database that includes all RMP submissions. Submit a request either online or in writing.

To access the online database, submit requests by first creating an account on the Freedom of Information Act (FOIA) site. Once the assessor has created the account, access the National RMP non-Offsite Consequence Analysis (non-OCA) Database via the FOIA online.

Submit the request online at:
https://foiaonline.regulations.gov

BE personnel can also submit a written request to the National FOIA Program, mailing address:

> National Freedom of Information Officer
> U.S. Environmental Protection Agency
> 1200 Pennsylvania Avenue, NW (2822T)
> Washington, DC 20460
> (202) 566-1667

The EPA also has regional FOIA Offices. Assessors may be able to find state-specific information by making a request through the region's office. EPA Regional FOIA Office contact information is available at the following website:
http://www2.epa.gov/foia/forms/contact-us-about-freedom-information-act-and-foia-requests#r5

If submitting a written request it should be signed and identify the need to access the RMP database (i.e., to help accomplish AF required TIC/TIM VA). State that any information obtained from the database will be considered sensitive (at a minimum, will be managed/labeled as For Official Use Only (FOUO) information in accordance with AF and Department of Defense (DoD) policy). In addition, include a note stating that access to Offsite Consequence Analysis data is not required (note: this data is extra-

sensitive and can delay the approval process; it is not needed for TIC/TIM VA purposes). There is a $25 fee to receive the database on a compact disc.

Important information to collect from an RMP report includes: facility name, address, latitude/longitude, emergency contact information, chemical name, and quantity. If available, notate any additional information from an RMP report (e.g., information on the process in which the chemical is used, accident information for the facility, and typical transportation routes the facility uses to transport the chemical).

Emergency Planning and Community Right-To-Know Act (EPCRA) Tier II data

Under Section 312 of EPCRA (40 CFR 370), facilities that maintain hazardous chemicals (substances requiring a Safety Data Sheet (SDS)) are required to submit Tier II reports to the LEPCs, SERC, and/or fire department annually. Tier II report formats can vary, such as: Excel spreadsheet, Adobe portable document format (pdf), or a Zip file for download into the EPA Computer-Aided Management of Emergency Operations (CAMEO) program. Some are available from the internet database E-Plan. Access to the E-Plan database requires users to establish an account that includes obtaining approval from a listed authorizing authority.

EPCRA Tier II data is generally the most comprehensive and up-to-date listing of TIC/TIM. Collect the EPCRA Tier II data for the area surrounding the installation by contacting the LEPC, SERC, or similar local emergency response representatives and departments of environmental health. A list of SERCs is available on the EPA website under Local Emergency Planning Requirements (http://www2.epa.gov/epcra/state-emergency-response-commissions-contacts). Contacting the local LEPC(s) or the SERC(s) may be a difficult task. However, AF installations assign an individual LEPC responsibilities (Emergency Manager or Fire Chief are most likely). This individual should be able to interface with LEPC members to obtain any information needed by assessors.

Reporting requirements for Tier II data vary from state to state. Some states may require Tier II data be submitted to the SERC at the state level while others may require reporting at the local level to the LEPC or even the local fire departments.

LEPCs will differ by location, and may be designated by town, county, city or region. Regional LEPCs will include any combination of these. Some states may have a different program to satisfy EPCRA Tier II reporting requirements. For example, California follows the Certified Unified Program Agency program that requires facilities to submit a Hazardous Material Business Plan on Forms #2730 and #2731, where appropriate.

Identify Tier II reports for facilities containing TIC of concern. Information to obtain from the Tier II reports consists of facility name, address, latitude/longitude (if available), emergency contact information, chemical name, quantity, and the number and size of containers. Some facilities may list a quantity range for materials stored onsite. If the Tier II report provides a range, include the highest value of the range on the inventory.

EPA Toxic Release Inventory

The toxics database portion of EPA's Envirofacts Data Warehouse provides data from EPA TRI reports, submitted under Section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) (Title 40 CFR 372). The database contains TRI information that applicable facilities (i.e., facilities that meet the criteria specified in Title 40 CFR 372.22) must submit annually to the EPA on EPA Form R. It is important to note that most of the toxic release information that facilities report on a Form R is for releases that occur during normal process operations, but it does have a section (Section 8.8) to report accidental release information. Visit the "Toxics" database portion of EPA's Envirofacts Data Warehouse at:
http://www.epa.gov/enviro/

5.3.1.2 Off-Base TIB

TIB data is more difficult to obtain than TIC data. Attempt to collect data for TIB located off the installation site by working with Base Public Health to contact the local or state Health Department. Identify facilities that have TIB of interest. Collect information from these facilities including the name of the facility, address, latitude/longitude (if available), emergency contact information, name and quantity of biological material. Locations that are likely to have TIBs onsite include hospitals, laboratories, research facilities and universities. When requesting TIB data explain very clearly why the information is being requested (i.e., to accomplish AF required TIC/TIM VA). Information related to TIB is extremely sensitive and most of the time facilities that have TIB onsite are reluctant to release related details. If the request for TIB is denied, it is advised not to submit another request. If this is the case, include a list of facilities around the installation that typically store TIBs as part of the inventory.

5.3.1.3 Off-Base TIR

TIR data, like TIB data, is very sensitive, so be sure to state clearly the reason the data is being requested (i.e., to accomplish AF required TIC/TIM VA). Collect data for TIR located off-base from the LEPC/SERC or the local fire department, by submitting a request for information on radiation sources surrounding the base when requesting Tier II reports. Emergency response personnel, including LEPC/SERC and the local fire

department may have an idea of any large industrial radiation sources within their jurisdiction. The Installation Fire Department personnel may also be a useful resource, especially if they are required to respond to off-base incidents.

Attempt to identify facilities that have TIR of interest. Typical facilities that possess TIR are hospitals/medical offices, nuclear power plants, engineering firms, etc. Information collected should include facility name, address, latitude/longitude (if available), emergency contact information, name of radioactive material, and quantity of radioactive material. It is likely that the assessor may not receive TIR data based on the request, or may receive only a list of general licenses that includes only the address where the TIR is registered. These lists generally do not include the isotope(s) or activity.

5.3.1.4 Additional Off-Base Information

Additional data sources such as the fire department (both on- and off-base) and the ATO may be able to obtain off-base TIC/TIM data and threat intelligence if necessary and available. BE may need to use a GIS map/imagery tool such as Google Earth™ to pinpoint the location of some facilities.

Maintain situational awareness, especially for facilities in the immediate area of the installation. There may be additional TIC/TIM nearby that fall below reportable threshold quantities, but could pose a threat to the installation due to proximity to the installation. Therefore, include visual observation of facilities within the vicinity of the installation during data gathering activities. If the assessor is aware of, or suspects that, this may be the case for facilities near the installation, make an effort to contact/visit the owner/operator of these facilities to determine if they possess any TIC/TIM of concern, and, if so, collect all applicable data.

5.3.2 Collect Transportation TIC/TIM Data

Assessors should be aware of the various transportation routes surrounding, and sometimes passing through, the base that may allow for the transport of TIC/TIM. The main routes of TIC/TIM transport include railways, highways, and waterways. Evaluate each for the possibility of a TIC/TIM release near the installation.

5.3.2.1 Railway TIC/TIM

Railways are a mode of transportation for large quantities of TIC/TIM. In order to collect rail data first identify the local railway route(s) within 20 miles of the installation and the companies that operate on them. Contact the hazardous material (HAZMAT) or EM POC for the railway that runs near the installation and request a density study

for the area of concern. Density studies (sometimes called traffic flow summaries) contain information on the transport of all hazardous materials between two locations.

It is important to identify and collect detailed information, including the railway company, the material name, and number of rail cars carrying the material. The railroad POC should provide the number of railcars carrying each chemical during a specific period (usually one year). From the density study, determine the number of railcars that travel by the installation per day and include that number in the inventory.

Create a map highlighting and identifying the railroad(s) in the local area using a GIS map/imagery tool such as Google Earth™ that shows the routes near the installation.

5.3.2.2 Highway TIC/TIM

Highways are another pathway for transport of TIC/TIM. Obtaining accurate highway TIC/TIM data can be difficult. Many locations have designated HAZMAT routes that are required for transport of hazardous materials, including TIC/TIM. Determine if there are designated HAZMAT routes around the installation by searching the National Hazardous Materials Route Registry found on the Department of Transportation (DOT) Federal Motor Carrier Safety Administration at: http://www.fmcsa.dot.gov/regulations/hazardous-materials/national-hazardous-materials-route-registry

Create a map highlighting and identifying these HAZMAT routes using a GIS map/imagery tool such as Google Earth™ that shows the routes near the installation.

5.3.2.3 Waterway TIC/TIM

If there is a navigable body of water in the area, then contact the local port authority and request information on any shipments of TIC/TIM transported on a nearby navigable waterway. Identify local port authority POCs on the Department of Homeland Security (DHS) Customs and Border Protection website (http://www.cbp.gov/).

It is important to identify and collect information that includes the company that owns the vessel (if available), the location and latitude/longitude of the potential release, the material name and quantity. Obtain latitude/longitude by using a GIS map/imagery tool such as Google Earth™ and pinpointing the location. Use the closest location to the installation as the potential TIC/TIM release site.

5.3.3 Collect On-Base TIC/TIM Data

In addition to off-base and transportation-related TIC/TIM information, assessors should collect data on any applicable on-base TIC/TIM. Collect the name of the shop/organization that owns or manages the material, the location (e.g., building number) of the material and its latitude/longitude, the material name, the material quantity, and the number and size of containers. Obtain latitude/longitude by using a GIS map/imagery tool such as Google Earth™ and pinpointing the location.

To identify all of the on-base TIC/TIM, BE may need to contact several installation POCs. Possible sources to contact and information to obtain from each include, but are not limited to, the following:

- HAZMART Pharmacy: obtain a list of hazardous materials (to include toxics) from the master chemical authorization database.
- Hazardous Waste Program Manager: obtain a copy of the latest hazardous waste stream inventory.
- Central Hazardous Waste Storage Facility Manager: obtain information on hazardous waste stored at the installation hazardous waste storage facility.
- Base Supply: obtain a list of any chemicals on-base not obtained through HAZMART Pharmacy.
- CE Storage Tank Manager: obtain information on any storage tanks containing toxic chemicals (e.g., hydrazine, hydrochloric acid).
- Installation Fire Department and/or EM: obtain information on response scenarios based on known chemicals on-base.
- Installation Radiation Safety Officer (RSO): obtain information on industrial radiation sources on-base. This information should include radiation sources that are not currently present but may be stored or used on the base. The RSO can contact the AF Radioisotope Committee (RIC) to identify what radiation sources are permitted on the installation.
- CE Environmental Manager or the area LEPC representative (or respective reporting documentation obtained by emergency response personnel) should be able to provide the installation's EPA Tier II chemical inventory.
- Tenant Organizations: BE may also need to obtain information from tenant organizations located on the installation that do not report hazardous material purchases through typical installation avenues.

5.4 Data Verification

Verify all of the data has been collected for accuracy and completeness. To ensure the information previously collected is accurate and complete, assessors can contact/visit the agencies storing the TIC/TIM for data verification. For example, some quantities

reported on RMP and Tier II reports may cover a wide range. Reports may not provide the number or size of containers in which chemicals are stored. In addition, assessors may need to verify latitude/longitude data from the RMP and Tier II reports. In some cases, the coordinate values listed are for the facility headquarters instead of the facility that stores the chemical or the latitude/longitude coordinates listed are simply incorrect. Attempt to verify coordinates by using a GIS map/imagery tool such as Google Earth™.

5.5 Compile Comprehensive TIC/TIM Inventory

Once the data has been verified, compile it into a comprehensive inventory. The purpose of this step is to combine the data so that it can be readily available for the Analysis Phase of the TIC/TIM VA process (Section 6.0). The assessment team may document the TIC/TIM inventory on Form 1-3 in the TIC/TIM VA Workbook (Appendix D). This form includes the data entry fields for the following:

- TIC/TIM Number (i.e., Identification Number)
- Name of the TIC/TIM
- Name and address of the facility possessing the TIC/TIM
- Emergency contact information for the facility
- Latitude and longitude of the facility possessing the TIC/TIM (for mapping)
- Type, size, and number of containers holding the TIC/TIM (if available)
- Maximum quantity (mass or radioactivity) of the TIC/TIM (if available)
- Distance and direction from the facility to the installation
- Any additional notes pertaining to the TIC/TIM

5.6 Collect Meteorological and Terrain Data

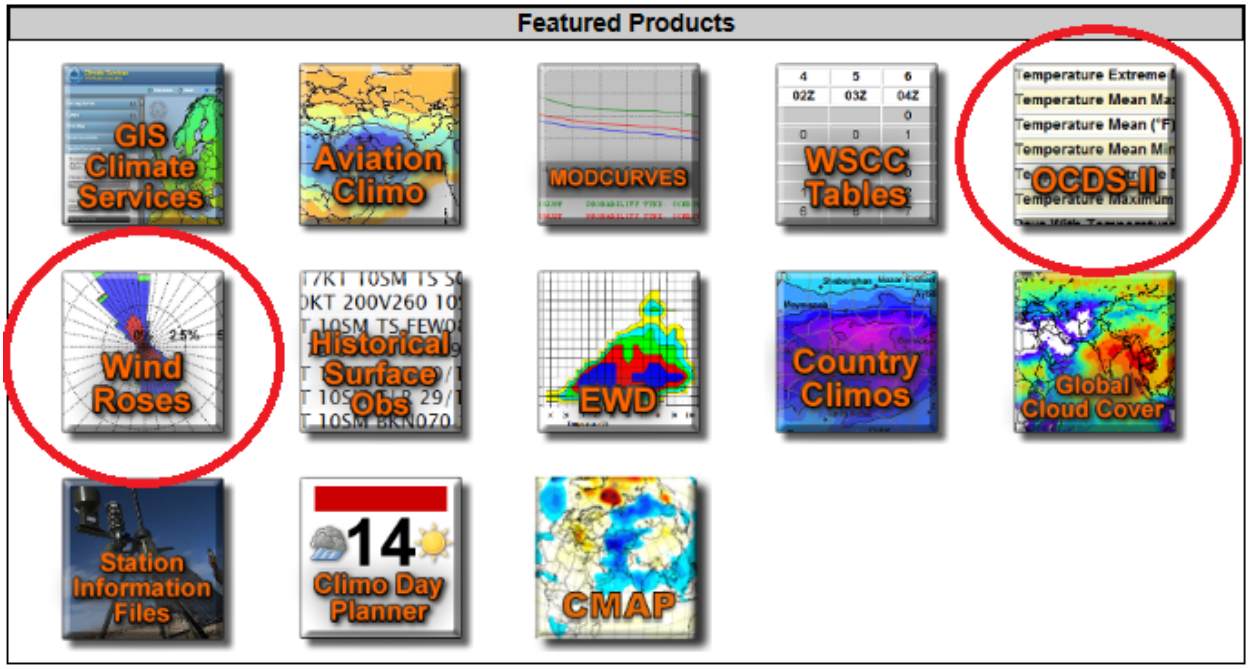
Meteorological information, including prevailing wind speed and direction, can be very useful in determining the timing and impact a TIC/TIM release may have on the installation.

The United States Air Force (USAF) 14th Weather Squadron is an excellent source for collecting meteorological data for military installations. Log into the common access card enabled site to obtain an annual or monthly wind rose for the installation. A wind rose indicates the prevailing wind direction for the installation. Visit the USAF 14th Weather Squadron online at:
https://www.climate.af.mil

Another tool available from the 14th Weather Squadron is the Operational Climatic Data Summary (OCDS-II). This tool, provided in tabular or spreadsheet format provides more detailed weather data including average temperature, wind speed, average cloud

coverage, relative humidity, etc. If the installation has a weather office, contact them for the meteorological data.

Figure 2. USAF 14th Weather Squadron Featured Products



5.7 Collect Natural Disaster and Accident Information

Collect data on past accidents, operation or maintenance failures, and natural disasters. Include information on the history of events on or near the base and the propensity for natural disasters in the region.

Consult with installation response personnel, and local emergency planning and response organizations (e.g., fire departments) to see if they can provide logs and other information regarding incidents that have occurred in the past that could occur again in the future. Several database sources contain chemical release reporting information required by various federal regulatory programs. The following is a summary of chemical release reporting databases:

- **RMP*Info:** The database contains a Five-Year Accident History section that requires facilities subject to RMP to disclose any accidents that resulted in onsite deaths, injuries, or significant property damage; or resulted in off-site deaths, injuries, evacuations, sheltering in place, property damage, or environmental damage.

- **National Response Center (NRC) Database:** The NRC database contains information on all oil, chemical, radiological, biological, and etiological discharges into the environment that are required to be reported to the NRC, including releases of hazardous substances under Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (40 CFR 302). Access the NRC database at the NRC website (http://www.nrc.gov/).

- **EPA's Envirofacts Data Warehouse – Toxics Database:** The Toxics database portion of EPA's Envirofacts Data Warehouse provides data from EPA TRI reports submitted under Section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) (40 CFR 372). The database contains TRI information that applicable facilities (i.e., facilities that meet the criteria specified in 40 CFR 372.22) must submit annually to the EPA on EPA Form R. It is important to note that most of the toxic release information that facilities report on a Form R is for releases that occur during normal process operations. However, the EPA Form R does have a section (Section 8.8) where accidental release information is reported (i.e., information on releases that are a result of catastrophic events or one-time events not associated with production processes). Access the database from the EPA website (http://www.epa.gov/).

- **National Climactic Data Center (NCDC) Storm Event Database:** NOAA's NCDC, located in Asheville, North Carolina, maintains the world's largest climate data archive and provides climatological services and data to every sector of the United States economy and to users worldwide. Records in the archive range from paleoclimatology data to centuries-old journals to data less than an hour old. The Center's mission is to preserve these data and make them available to the public, business, industry, government, and researchers. The database currently contains data from January 1950 to December 2014, as entered by NOAA's National Weather Service. Due to changes in the data collection and processing procedures over time, there are unique periods of record available depending on the event type. Visit the NCDC online at: (https://www.ncdc.noaa.gov/stormevents/).

- **The Center for Research on the Epidemiology of Disasters' (CRED's) Emergency Events Database (EM-DAT):** For information on natural disasters outside the U.S., use the CRED's EM-DAT to help characterize a region's history in experiencing disasters. It is not necessary to conduct a detailed inventory or analysis of past accidents or other unintentional events. The purpose of this data collection effort is to provide a general indication as to the type of events that may occur at the site of interest. The data collected in this step may be useful

during the Analysis Phase in evaluating the probability of occurrence of various scenarios. Visit CRED online at: (http://www.emdat.be/).

5.8 Collect Data on TIC/TIM Characteristics

To evaluate TIC/TIM in this methodology, assessors should obtain information with respect to the potential for a TIC/TIM to cause any of three health effects: deaths, severe injuries/illnesses, or minor injuries/illnesses. To identify this potential for each TIC/TIM, the chemical concentrations or radiological dosage that can cause these varied effects should be identified to determine if there may be an impact. This chemical concentration or radiological dosage is termed herein as a Level of Concern (LOC).

5.8.1 TIC Levels of Concern (LOC)

The three LOCs used to define the three possible health effects for TIC are as follows:

- LOC_1—the threshold concentration or dosage at or above which may cause minor injury/illness or non-negligible impacts
- LOC_2—the threshold concentration or dosage at or above which may cause severe injury/illness
- LOC_3—the threshold concentration or dosage at or above which may cause death

Typically, LOCs are defined in units of parts per million (ppm). To convert an LOC from ppm to mg/m^3, the assessor needs to know the molecular weight of the chemical, LOC_{ppm}, and may need to collect some other chemical specific information (e.g., density to convert from volume to mass). Use the following equation to convert from ppm to mg/m^3:

Equation 1: $LOC_{mg/m3} = LOC_{ppm}*(MW/24.45)$

Where:

$LOC_{mg/m3}$ = LOC value calculated (mg/m^3)
LOC_{ppm} = original LOC value (ppm)
MW = molecular weight of the chemical
24.45 = conversion factor (from ppm to mg/m^3)

Useful chemical data is available through the National Institute for Occupational Safety and Health (NIOSH) database online (http://www.cdc.gov/niosh/). Other sources of useful data include the NIOSH Pocket Guide to Chemical Hazards, the CAMEO Database of Hazardous Materials (http://cameochemicals.noaa.gov/), and the Centers

for Disease Control (CDC) Toxicological Profile Information website (http://www.atsdr.cdc.gov/toxprofiles/Index.asp). Information on chemical properties can also be found on SDSs. SDSs for chemicals used by the AF are available from the Defense Logistics Information System (DLIS) Hazardous Materials Information Resource System (HMIRS) (http://www.dlis.dla.mil/hmirs/).

5.8.2 Radioactive Material Levels of Concern

A single set of LOC values is used for all radioactive material.

LOCs for gamma-emitting radiation are absorbed dosage levels expressed in units of grays (Gy). For all gamma-emitting radioactive materials:

- Zone 1 (LOC_3) is an area where absorbed dosages exceed 3.0 Gy over a one-hour period
- Zone 2 (LOC_2) is an area where absorbed dosages exceed 1.5 Gy over a one-hour period
- Zone 3 (LOC_1), is an area where absorbed dosages exceed 0.35 Gy over a one-hour period

These absorbed dosage values are based on a review of recommendations provided by the National Council on Radiation Protection and Measurements 2001.

Further information on LOCs, including specific definitions of each, may be found in Appendix B.

6. PHASE III: INFORMATION PROCESSING ACTIVITIES

Evaluate the TIC/TIM to determine their potential impact to the base. From this point on, treat the data and analyses as classified in accordance with the DTRA SCG as directed by AFI 10-245, *Antiterrorism (AT)*, and DoDI 2000.16, *DoD Antiterrorism Standards*. Classify any information linking a vulnerability or concern with a specific U.S. military site as CONFIDENTIAL (C) or SECRET (S). All due caution should be taken to protect this information, to include working on a computer designed to handle SECRET documents (i.e., a Secret Internet Protocol Router Network computer). Appendix A contains more detailed information on the proper classification and handling of classified material.

6.1 Screen Toxic Substances to Determine Potential Impact to Base

Once the assessment team has completed the Comprehensive TIC/TIM Inventory (Section 5.4) to collect the necessary data, then the assessment team should begin to screen the TIC/TIM to determine which ones may affect the base. As mentioned in the definitions at the beginning of Section 5.0, TIB and TIR which are only alpha or beta emitters are typically inventoried in the Data Collection Phase but are not further evaluated in the Analysis Phase (i.e., typically only TIC and gamma-emitting TIR are potentially evaluated in the Analysis Phase).

In the past, BE has used plume modeling as a tool in the screening process to determine if a release could affect the installation. Plume models are effective because they generally show the three LOCs and assessors can easily determine the severity level of a release. However, plume modeling is very time consuming and is not a requirement for BE. As mentioned earlier, BE can work with CE or contact DTRA for plume modeling.

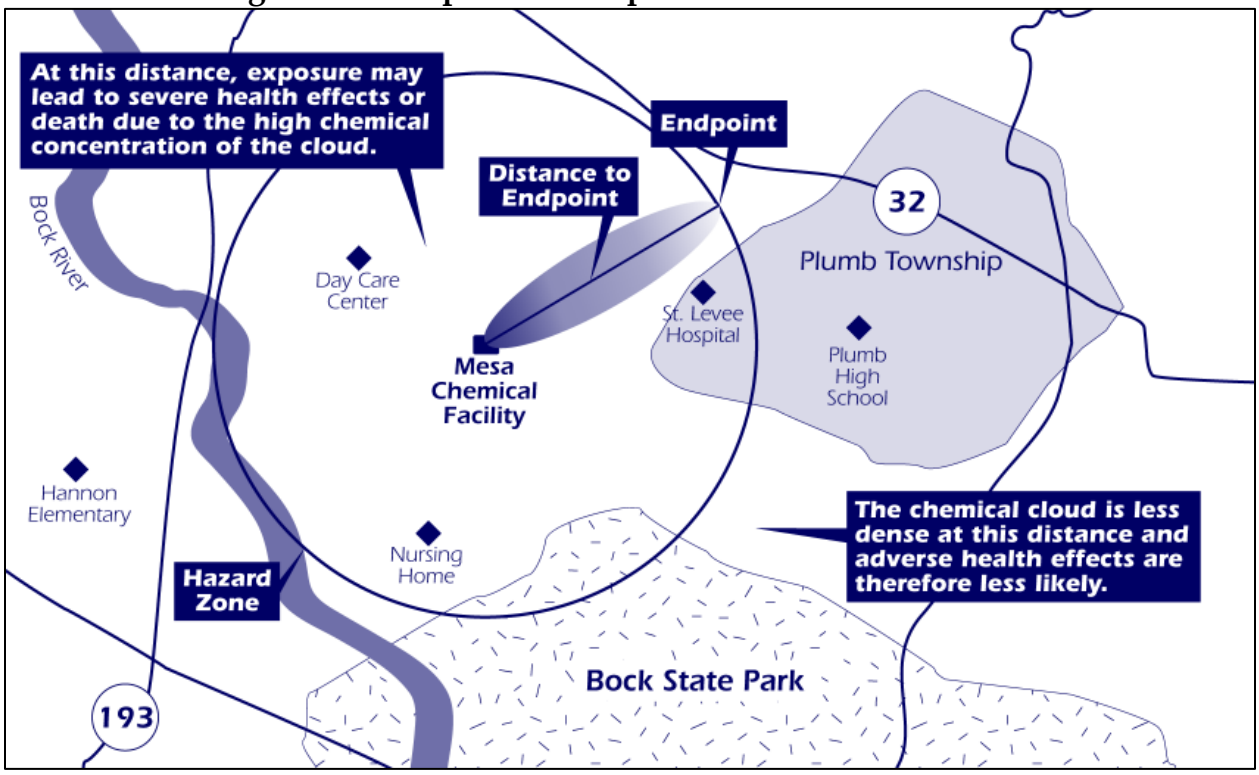
To accomplish this screening, one tool that is available is RMP*Comp. NOAA and the EPA developed RMP*Comp, a planning tool designed to help easily identify high-priority hazards at a facility. Unlike plume models that identify all three LOCs, RMP*Comp simply provides the distance to a Toxic Endpoint; therefore, three scenarios will need to be run in order to determine the severity of impact a release may have on the installation. Refer to Appendix C for detailed instructions on the use of RMP*Comp.

RMP*Comp is available for use online at:
https://cdxnodengn.epa.gov/cdx-rmp-maintain/action/rmp-comp.

Download the software for use offline from the EPA website at:
http://www.epa.gov/swercepp/tools/rmp-comp/rmp-comp.html.

The below example of a map found in an RMP illustrates terminology: endpoint, estimated distance to toxic endpoint, and the hazard zone for one possible scenario. The figure is reproduced from Guides to Chemical Risk Management, Evaluating Chemical Hazards in the Community: Using an RMP's Offsite Consequence Analysis, with permission from the National Safety Council's Environmental Health Center, May 1999.

Figure 3. Example RMP Map for One Possible Scenario



6.2 Determine the Risk of Each Scenario

When dealing with TIC/TIM, it is important to identify the risks associated with various contaminant sources. In accordance with AF ORM practices, there are two main elements of risk: probability and severity.

Evaluate relative risks associated with each TIC/TIM scenario to provide a mechanism for planning in case of a release and the identification of capability gaps. The risks identified are not intended to be absolute, but rather a relative indicator of the perceived severity and probability ratings associated with each scenario.

6.2.1 Determine the Severity Level of Each Scenario

The first step in determining the risk level of a scenario is to determine the severity rating. Categorize the severity level with respect to potential casualties (i.e., fatalities and injuries).

Guidance provided below for determining severity levels is for releases of single substances; this guidance does not address mixtures of substances that may react and/or result in different chemical and physical properties from those inventoried. Additionally, the severity evaluated in this methodology relates only to the acute effects of the toxic release and/or radioactive exposure; the severity level does not consider possible long-term chronic effects.

Severities from chemical releases or radioactive exposures are determined based on hazard zones that result from the release/exposure and how the hazard zones affect the base. Use the following steps to determine the severity level for each scenario:

1. Identify quantity of substance released/exposed.
2. Determine hazard zones toxic endpoint.
3. Determine severity rating.

The specific procedures used to delineate hazard zones depend on whether the substance is a chemical or radiological material.

6.2.1.1 Determine the Chemical Toxic Endpoint

RMP*Comp provides the distance from a facility (release point) to a Toxic Endpoint (based on ERPG2) using the quantity the facility has reported. This tool determines if a release at an identified facility will affect the installation.

6.2.1.2 Delineate Radiological Hazard Zones

Hazard zones for gamma-emitting radioactive substances are zones where an exposure can potentially cause injury or death, delineated as follows:

- Zone 1 - area where death may result; equal to LOC_3
- Zone 2 - area where severe injuries/illnesses may result; equal to LOC_2
- Zone 3 - area where minor injuries/illnesses may result; equal to LOC_1

In an unobstructed environment, the zones would be three concentric circles. In reality, because walls and other shielding may exist, the zones are difficult to define and may

take on irregular shapes. For the purposes of this assessment methodology, assume conservative conditions corresponding to an unobstructed environment.

Calculate the distances for each of the three hazard zones based on the type and quantity (activity) of the gamma-emitting radioactive material. The three zone distances are calculated using the following equation (derived from Radiological Health Handbook, 1970; the Handbook of Radiological Protection, 1971; and Radioisotopes in Biology, 2002):

Equation 2: $d_{1,2,3} = 3.28*(k*A*t/LOC_{3,2,1})^{0.5}$

Where:

$d_{1,2,3}$ = Distance to absorbed dosage level for each zone [i.e., distance to maximum extent of the zone] (in ft)
3.28 = Conversion factor (from meters to ft)
k = Gamma Ray Constant

- for Actinum-227, k = 5.95 x 10^{-8} Gy m^2/MBq hr
- for Cesium-137, k = 8.92 x 10^{-8} Gy m^2/MBq hr
- for Cobalt-60, k = 3.57 x 10^{-7} Gy m^2/MBq hr
- for Iridium-192, k = 1.30 x 10^{-7} Gy m^2/MBq hr
- for Radium-226, k = 2.23 x 10^{-7} Gy m^2/MBq hr
- for Selenium-75, k = 5.41 x 10^{-8} Gy m^2/MBq hr
- for Thulium-170, k = 6.76 x 10^{-10} Gy m^2/MBq hr

A = Activity of the radioactive source measured in MBq; if activity is reported in Ci, use 1 Ci = 3.7 x 10^4 MBq
t = Exposure time (hr); 1 hour is assumed in this method
$LOC_{3,2,1}$ = Absorbed dose limit (Gy);

- for Zone 1, LOC_3 = 3.0 Gy
- for Zone 2, LOC_2 = 1.5 Gy
- for Zone 3, LOC_1 = 0.35 Gy

6.2.1.3 Determine the Severity Level of a Chemical Release

The severity of a release depends on the impact to the installation. Using the RMP*Comp tool, as many as three scenario assessments may need to be performed for each TIC/TIM.

- Scenario 1 - Enter the entire quantity reported by the facility into RMP*Comp. If the estimated distance to toxic endpoint (as shown in Figure 3 above) reaches the installation, perform a second scenario assessment.

- Scenario 2 - Enter two-thirds of the quantity reported by the facility into RMP*Comp. If the estimated distance to toxic endpoint reaches the installation, perform a third and final scenario assessment.

- Scenario 3 - Enter one-third of the quantity reported by the facility into RMP*Comp.

Use the following guidelines to determine severity ratings for each TIC/TIM release:

- If the estimated distance to toxic endpoint for all three scenarios reaches the installation, then the severity level is catastrophic.

- If the estimated distance to toxic endpoint for scenarios 1 and 2 reaches the installation, then the severity level is critical.

- If the estimated distance to toxic endpoint for only scenario 1 reaches the installation, then the severity level is moderate.

- If the installation is located beyond the estimated distance to toxic endpoint for all three scenarios, then the severity level is negligible.

Once the severity level of a release scenario is determined, record it on Form 1-6 in Appendix D.

6.2.2 Determine the Probability of Each Scenario

After determining the severity level of a potential impact to the installation, determine the probability of each scenario affecting the installation (i.e., a hazardous exposure would occur). During the TIC/TIM process, identify capability gaps based on the TIC/TIM identified in the area surrounding the installation. The more capability gaps identified, the more likely it is that a release will have an impact on the installation. Some examples of capability gaps are:

- The installation does not have the proper equipment to detect exposure levels for a specific TIC assessed at or below a threshold level deemed dangerous.

- The installation does not have the proper Personal Protective Equipment (PPE) to protect personnel against the TIC assessed. For example, the installation lacks the correct cartridges/filters for respirators, Tyvek, and SCBA gear to protect against a potential release of a large quantity of ammonia located at a new distribution center that moved into the area.

- There have been reportable accidents or releases in the previous 5-year history of the facilities identified during the assessment. (Locate this information in the RMP report, by searching online, or from common knowledge – the local Fire Department, LEPC POC, Installation Emergency Manager or Fire Chief may be good sources of information on this topic).

- Installation response plans are not up-to-date (generally require annual updates).

- Installation procedure(s) to notify personnel of an incident/emergency are lacking.

- Procedures on whether personnel should evacuate or shelter in place do not exist.

- The installation has only one evacuation route (smaller installations, especially Air National Guard or Reserve may only have one operable gate). If this is the case, identify a secondary evacuation route for the installation in case of an incident/release that makes that gate unusable for evacuation.

Once the number of capability gaps at the installation is determined, use this information to determine the probability that a release will affect the personnel and the mission.

Example: There is the potential for an ammonia release at a facility (XYZ) identified in the data collection phase of the assessment. The release is more likely to impact the installation if the proper detection equipment is not available, response plans are not up-to-date, and there is no secondary evacuation route (three gaps) than it would if only the response plans were not up-to-date (one gap).

Evaluate the probability associated with each scenario using the following categories and definitions:

- **3+ (Frequent and/or Likely - Likely to occur immediately or within a short period of time)**
  Identified three or more capability gaps for a scenario/release event, consider the probability likely.

- **2 (Occasional - Probably will occur in time)**
  Identified two capability gaps for a scenario/release event, consider the probability occasional.

- **1 (Seldom - Possible to occur in time)**
  Identified only one capability gap for a scenario/release event, consider the probability seldom.

- **0 (Unlikely - Unlikely to occur)**
  Identified any capability gaps for a scenario/release event, consider the probability unlikely.

It is not required for an absolute probability to be determined, rather, it is more important to demonstrate a relative probability among the different scenarios evaluated using the factors listed above.

Once the probability is assigned for each scenario, record it on Form 1-6 in Appendix D.

6.2.3 Assign a Risk Level

Once the severity and probability ratings are determined for each scenario, use the RM Risk Assignment Matrix to identify the overall risk category for each scenario.

Table 1. RM Risk Assignment

SEVERITY (BASED ON DISTANCE TO TOXIC ENDPOINT)	PROBABILITY (BASED ON # OF CAPABILITY GAPS)			
	3+ (Frequent/Likely)	**2 (Occasional)**	**1 (Seldom)**	**0 (Unlikely)**
Catastrophic	Extremely High	High	High	Moderate
Critical	High	Moderate	Moderate	Low
Moderate	Moderate	Moderate	Low	Low
Negligible	Low	Low	Low	Low

6.3 Example Calculations for Risk Determination

Example calculations to determine the risk associated with a chemical and a radiological release scenario are provided below.

6.3.1 Example Calculations for Risk Determination of a Chemical Release Scenario

Facility XYZ is a large distribution center 2.25 miles north of the installation. The Tier II report shows that they have 100,000 pounds of ammonia onsite for use in the refrigeration system. The area between Facility XYZ and the installation is a developed industrial park.

TIC/TIM Name: Ammonia
Facility Name: XYZ
Off-Base or On-Base TIC/TIM: Off-base
Distance from Source to Closest Portion of Installation: 2.25 miles
Amount Released: 100,000 pounds

Step 1: Go to the EPA's RMP*Comp site (https://cdxnodengn.epa.gov/cdx-rmp-maintain/action/rmp-comp) and then:

- Click on Begin (Meteorological Conditions are included in RMP*Comp for all Worst-Case Scenarios (Wind Speed: 1.5 meters/second (3.4 miles/hour) Temperature: 77°F)
- Select Ammonia (anhydrous) from the list of chemicals
- Select Scenario Type: Worst-Case
- Select Physical State: Liquefied under pressure
- Select Quantity Released: Enter the full amount of 100,000 pounds
- Select "Urban" for terrain type
- Click on the Submit button at the bottom of the page.

RMP*Comp provides an estimated distance to toxic endpoint of 3.6 miles. The closest portion of the installation is 2.25 miles from the release point. Because this release will reach the installation, perform a second scenario using two-thirds of the total quantity.

Step 2: Return to the RMP*Comp site and:

- Click on Begin (Meteorological Conditions are included in RMP*Comp for all Worst-Case Scenarios (Wind Speed: 1.5 meters/second (3.4 miles/hour) Temperature: 77°F)
- Select Ammonia (anhydrous) from the list of chemicals
- Select Scenario Type: Worst-Case
- Select Physical State: Liquefied under pressure
- Select Quantity Released: Enter the full amount of 66,667 pounds
- Select "Urban" for terrain type
- Click on the Submit button at the bottom of the page.

RMP*Comp provides an estimated distance to toxic endpoint of 3.1 miles. The closest portion of the installation is 2.25 miles from the release point. Because this release will reach the installation, perform a third scenario using one-third of the total quantity.

Step 3: Return to the RMP*Comp site and:

- Click on Begin (Meteorological Conditions are included in RMP*Comp for all Worst-Case Scenarios (Wind Speed: 1.5 meters/second (3.4 miles/hour) Temperature: 77°F)
- Select Ammonia (anhydrous) from the list of chemicals

- Select Scenario Type: Worst-Case
- Select Physical State: Liquefied under pressure
- Select Quantity Released: Enter the full amount of 33,333 pounds
- Select "Urban" for terrain type
- Click on the submit button at the bottom of the page.

RMP*Comp provides an estimated distance to toxic endpoint of 2.0 miles. The closest portion of the installation is 2.25 miles from the release point. This scenario will not reach the installation.

Step 4: Determine the severity level for the scenario:

- Based on the definitions above, since scenarios one and two reach the installation, but scenario three does not, the severity for this release would be critical.

Step 5: Determine the probability rating for the scenario:

- During the assessment, two capability gaps were identified: a review of the Installation Emergency Management Plan revealed that it has not been updated in the last two years, and there is currently only one evacuation route from the installation because the secondary gate is under construction for the next six months. Based on this information (two capability gaps), the probability rating would be occasional.

Step 6: Determine the overall risk level for the scenario:

- Using the severity level of critical and the probability rating of occasional the risk level for this release scenario would be moderate.

6.3.2 Example Calculations for Risk Determination of Radiological Release Scenario

The installation hospital complex has a medical device that contains Cobalt-60.

TIC/TIM Name: Cobalt-60
Facility Name: Base Hospital Complex
Off-Base or On-Base TIC/TIM: On-base
Scenario Type: Worst-case
Description of Exposure: Full exposure of Cobalt-60 from a medical equipment device
Activity: 5,500 Curies

Step 1: Convert the activity from units of Curies to units of megabecquerels (MBq).

$$5{,}500 \text{ Ci} * (3.7 \times 10^4 \text{ MBq/Ci}) = 2.035 \times 10^8 \text{ MBq}$$

Step 2: Calculate the three distances for the hazard zones, using Equation 2 provided in Section 5.2.1.2.

$$d_{1,2,3} = 3.28*(k*A*t/LOC_{3,2,1})^{0.5}$$

From Section 6.2.1.2, k (Gamma Rate Constant) = 3.57×10^{-7} Gy m^2/MBq hr and t (Exposure Time) = 1 hr; Step 1 found A (Activity) = 2.035×10^8 MBq

Zone 1 = 3.28 ft/m * $[(3.57 \times 10^{-7}$ Gy m^2/MBq hr)$(2.035 \times 10^8$ MBq)(1 hr)/(3.0 Gy)$]^{0.5}$ = 16.1 ft

Zone 2 = 3.28 ft/m * $[(3.57 \times 10^{-7}$ Gy m^2/MBq hr)$(2.035 \times 10^8$ MBq)(1 hr)/(1.5 Gy)$]^{0.5}$ = 22.8 ft

Zone 3 = 3.28 ft/m * $[(3.57 \times 10^{-7}$ Gy m^2/MBq hr)$(2.035 \times 10^8$ MBq)(1 hr)/(0.35 Gy)$]^{0.5}$ = 47.3 ft

Step 3: Determine the severity rating using the hazard zone distances. Since the source is already located on the installation and the Zone 1 distance is great enough to impact nearby personnel, assign a severity rating of catastrophic.

Step 4: Determine the probability of this scenario occurring. A review of accident history information available reveals that the installation hospital complex has not had a reportable radioactive exposure incident in the last five years. Research also shows that in general there have been very few incidences involving Cobalt-60 exposure from this type of medical equipment device. Based on this information, assign a probability of unlikely.

Step 5: Use the severity rating, the probability, and the criteria to assign an overall risk level. Based on this information and the ranking guidelines provided in the ORM Risk Assignment table, assign a risk level of moderate.

Record the overall risk level of a release scenario in Form 1-6 in Appendix D. Be sure to minimize identifying information in the Risk Assignment Table to limit the sensitivity of the data. The table below provides examples of assigning risk levels to both scenarios.

Table 2. Risk Level Assignment Examples

TIC/TIM No.	TIC	SEVERITY	PROBABILITY	RISK LEVEL
1	Chlorine	Critical	2 (Occasional)	Moderate
2	Cobalt-60	Catastrophic	0 (Unlikely)	Moderate

7. PHASE IV: DEVELOP THE TIC/TIM VULNERABILITY ASSESSMENT REPORT

After the field assessment, the assessment team should document and consolidate the results and develop a report. Since risk assessment is not an exact science, it is important to maintain records of expert opinions and judgments made during each step of the process. Document and maintain data for further analysis, and use it to support proposed recommendations and alternatives. Provide this documentation to decision-makers for review and use it as a baseline for follow-on or future analyses and assessments. The report should include the following:

- Executive Summary
- Introduction
- Methodology
- Scope and Limitations
- TIC/TIM Inventory
- Risk Assessment
- Conclusion
- References (to include interviews with POCs and other stakeholders)
- Appendices (forms, maps/plots, weather data, comprehensive inventory)

BE should present the results of the assessment to the Medical Readiness Committee (MRC) and the Antiterrorism Working Group (ATWG). Assessors may provide briefing materials for this purpose. The materials should provide an overview of the major types of TIC/TIM and their associated risk levels.

7.1 Baseline Vulnerability Assessments and Updates

AFI 10-245 states that the MDG shall: "Serve as the installation lead for conducting annual TIC/TIM and Food/Water VAs. Enter vulnerabilities and observations in CVAMP within 90 days of the signed assessment report. Monitor, track and manage these vulnerabilities until resolved by mitigation or installation commander's documented acceptance of risk. Ensure assessment reports are formatted for entry into CVAMP."

This guide is formatted to assist BE in creating an initial, comprehensive TIC/TIM VA which requires a significant level of effort to accomplish. Refer to this initial, comprehensive assessment as a baseline assessment. AF guidance requires completion of an annual TIC/TIM VA.

The information gathered in the baseline assessment should not vary significantly from year to year. The same level of effort exerted during the baseline assessment will not be

required during the annual assessment efforts. A baseline TIC/TIM VA should be accomplished as outlined in this guidance and updated annually. The term "update" is not definitive, but suggests a reduced level of effort in relation to a baseline assessment.

The baseline assessment needs to be re-accomplished periodically. The frequency required for the baseline assessment will be site-specific and based on the number and types of changes that have occurred since the baseline assessment was completed. Over time, new facilities may move into the area. Others may relocate out of the area. Still others may change the processes and/or chemicals at the facility. These changes will have an impact on the validity and usefulness of the report. In addition, policy and technology changes may render the report in need of significant modification (e.g., changes in AT/FP regulations, changes to chemical LOC values, and improvements in modeling techniques). Furthermore, it is likely that a majority of the personnel involved in the initial TIC/TIM VA will have moved on and been replaced by new personnel that are unfamiliar with the details of the assessment.

Annual assessment updates include a verification of the information in the Comprehensive TIC/TIM Inventory. This verification should include a review of the most current data found in TIC/TIM data sources (i.e., RMP database, Tier II reports, transportation information, base hazardous materials inventory, etc.) and comparing these data to the information in the Comprehensive TIC/TIM Inventory.

Place each facility into one of the following four categories when conducting annual updates, and update the Comprehensive TIC/TIM Inventory and assessment report accordingly. The four categories can include:

1. **Facilities determined in the baseline assessment to have a potential impact to the installation in the event of a release.** Review these sources and determine if there was a significant change in the quantity of the TIC/TIM (increase or decrease) or in the location of the TIC/TIM (closer to or farther from the installation). Sources with significant changes should be re-evaluated using methodology in this guide to determine the probability of a release affecting the installation.

2. **Facilities identified in the baseline assessment that were determined not to have a potential impact to the installation in the event of a release.** Review these sources to determine if there was a significant change in the quantity of the TIC/TIM (increase) or in the location of the TIC/TIM (closer to the installation). Sources with significant changes should be re-evaluated using methodology in this guide to determine the probability of a release affecting the installation if at least one hazard zone reaches the installation.

3. **Facilities identified in the baseline assessment determined to be nonexistent during the inventory verification.** If there are sources that were identified in the baseline assessment that no longer exist, (e.g., the facility closed or they are using new chemicals for the process at the same facility), then remove the TIC/TIM from the comprehensive TIC/TIM inventory.

4. **New facilities not identified in the baseline assessment.** Examples include a new chemical stored at an existing local industrial facility, a new facility that uses/stores at least one TIC/TIM, and changes to the cargo carried on nearby transportation corridors. Assess new facilities as detailed in this guide.

Verify the data in the comprehensive TIC/TIM Inventory including the facility address, emergency contact information, and other facility-specific information.

In addition to reviewing the comprehensive TIC/TIM inventory, the annual assessment updates should include a review of applicable LOC values and the most current TIC/TIM VA methodology to ensure the data and procedures used in the previous assessment are still valid. Finally, the annual assessment update should also identify real-world release incidents (both locally and within industry) that have occurred since the last assessment. These incidents may have an effect on the probability used to determine the overall risk level for a particular TIC/TIM release.

Table 3. Example of a "Record of TIC/TIM Updates" Table

INSTRUCTIONS FOR UPDATING THE TIC/TIM REPORT: The TIC/TIM report is a living document designed to: 1) reflect the most current information within the body of the report; and 2) provide a historical record of changes that have occurred over time since the baseline TIC/TIM VA. Each time a TIC/TIM VA is updated, implement the following actions:

1) Update the report where applicable. Examples include adding or deleting rows from tables, and modifying text with updated observations or conclusions.

2) Summarize any changes made to the report since the last TIC/TIM VA in this "Record of TIC/TIM Updates" table. Include the date of the change and the individual(s) responsible for making the change. Also, be sure to precede all Summary of Change inputs with the appropriate classification.

3) Change the dates on the report cover and the declassification dates in the page headers and footers and, if necessary, change the report classification to reflect the latest TIC/TIM VA.

DATE OF BASELINE TIC/TIM VULNERABILITY ASSESSMENT: 27 March 2013

Date of Change / Posted By	**Summary of Change**
22 Mar 2014 / Capt. John Jones	Addition of a new source (150,000-pound ammonia tank at ABC Facility) to the comprehensive TIC/TIM inventory. Source assessed and added to report.
22 Mar 2014 / Capt. John Jones	Removal of a previous source (1-ton chlorine tank at DEF Facility no longer exists) from the comprehensive TIC/TIM inventory and report.
22 Mar 2014 / Capt. John Jones	Change in AEGL values for acrolein. Re-assessed acrolein tank at GHI Facility and included revised information in report.
18 Mar 2015 / Capt. Ron Smith	Change in the quantity of sulfur dioxide at JKL Facility (increase from 14,000 pounds to 20,000 pounds). Information updated in comprehensive TIC/TIM inventory. Source re-assessed and information revised in report.
18 Mar 2015 / Capt. Ron Smith	Change of location of MNO Facility that has a 10,500-pound tank of carbon disulfide (moved 5 miles north of previous location and further from the installation). New location was updated on comprehensive TIC/TIM inventory and source was re-assessed. Determined there is no longer an impact and source was removed from report.

Date of Change / Posted By	Summary of Change
13 Mar 2015 / 1st Lt Jane Johnson	Real-world incident occurred in Aug 2014 at PQR Plant involving their hydrochloric acid tank; updated probability from Seldom to Occasional for that scenario and re-determined risk level.

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GLOSSARY

Acute Exposure Guideline Levels (AEGLs): Estimated concentrations at which most people—including sensitive individuals such as old, sick, or very young people—will begin to experience health effects if they are exposed to a toxic chemical for a specific length of time. The National Research Council's Committee on Toxicology develops these concentrations.

Air Military Exposure Guidelines (Air-MEGs): Estimated toxic concentrations for deployed settings classified as catastrophic, critical, marginal and negligible. The USAPHC developed these concentrations based on a specific length of time. For the purposes of this document, the concentrations established for a one-hour exposure are used. (TG 230, 2013.)

Asset: Any person, facility, equipment, or activity that has value to the AF or to a potential adversary.

Atmospheric Stability Classes: Pasquill stability classes (ranging from "A" to "F") are meteorological categories of atmospheric conditions. Pasquill stability class A represents unstable conditions under which there are strong sunlight, clear skies, and high levels of turbulence in the atmosphere, conditions that promote rapid mixing and dispersal of airborne contaminants. At the other extreme, class F represents light, steady winds, fairly clear nighttime skies, and low levels of turbulence. Airborne contaminants mix and disperse far more slowly with air under these conditions, and may travel further downwind at hazardous concentrations than in other cases. Stability class C, midway between A and F, is used for neutral conditions, applicable to moderate winds and moderate to slight sunlight.

Capability gap: For the purposes of this document, a capability gap is a deficiency on the installation related to a specific TIC/TIM identified during the assessment.

Catastrophic: For the purposes of this document, for a chemical release, catastrophic is defined as a severity rating that results when the "estimated distance to toxic endpoint" (provided by RMP*Comp) for three scenarios related to a release will reach the installation. This rating also applies if the installation falls within Hazard Zone 1 of a radiological release (containing a concentration greater than LOC_3) which may cause death, loss of facility/assets, or result in grave damage to national interests.

Critical: For the purposes of this document, for a chemical release, critical is defined as a severity rating that results when the "estimated distance to toxic endpoint" (provided by RMP*Comp) for two scenarios related to a release will reach the installation. This rating also applies if the installation falls within Hazard Zone 2 (containing a concentration greater than LOC_2) which may cause major injury, illness, property damage, damage to national service or command interests, or degradation to efficient use of assets.

Emergency Response Planning Guidelines (ERPGs): Estimated concentrations developed by American Industrial Hygiene Association that use toxicological, physical, and chemical properties for emergency planning to forecast potential health effects caused by exposure to toxic chemicals. Concentrations are established for one-hour exposure periods and may not accurately reflect the health effects for hypersensitive individuals.

Estimated distance to toxic endpoint: The estimated distance the toxic area of a TIC/TIM release will travel as calculated by RMP*Comp.

Frequent/Likely: It is one probability rating along an increasing scale of probability. For the purposes of this methodology, the value is defined as a probability rating determined when three or more capability gaps are identified for a release scenario.

Hazardous Materials (HAZMAT): Any material that is flammable, corrosive, an oxidizing agent, explosive, toxic, poisonous, etiological, radioactive, nuclear, unduly magnetic, a chemical agent, biological research material, compressed gases, or any other material that, because of its quantity, properties, or packaging, may endanger life or property (AFI 10-2501, 2009).

Installations: AF activities including bases, stations, and annexes (both contractor- and Government-operated), hospitals, terminals, and other special mission facilities, as well as those used primarily for military purposes. Also includes any activity of the AF that employs members of the workforce in peacetime or will employ them in the event of mobilization (Air Force Document 070924-055).

Level of Concern (LOC): LOCs for toxic materials are "threshold concentrations," above which individuals may receive specific harmful effects. The TIC/TIM Vulnerability Assessment methodology establishes three different LOCs, which define the health effects of toxic materials on individuals.

Local Emergency Planning Committee (LEPC): A committee established by the State commission for each emergency planning district to plan and coordinate local emergency response actions (AFI 10-2501, 2009).

Moderate: For the purposes of this document, for a chemical release, moderate is defined as a severity rating that results when the "estimated distance to toxic endpoint" (provided by RMP*Comp) for one scenario related to a release will reach the installation. This rating also applies if the installation falls within Hazard Zone 3 (containing a concentration greater than LOC_1) which may cause minor injury, illness, property damage, damage to national service or command interests, or degradation to efficient use of assets.

Negligible: For the purposes of this document, negligible is defined as a severity rating for a scenario where the Toxic Endpoint (as determined by RMP*Comp) or LOC does not reach the installation and, therefore, presents a minimal threat to safety or health, property, national service or command interests, or efficient use of assets.

Occasional: It is one probability rating along an increasing scale of probability. For the purposes of this document, occasional is defined as a probability rating determined when two capability gaps are identified for a release scenario.

Risk Management (RM): RM is a decision-making process to systematically evaluate possible courses of action, identify risks and benefits, and determine the best course of action (COA) for any given situation. RM goals include 1) enhance mission effectiveness, while preserving assets and safeguarding health and welfare, and 2) integrating RM into mission processes, ensuring decisions are based upon assessment of risk integral to the activity and mission.

Probability: Probability is the degree of certainty that an event may occur, regardless of the severity of the event. For the purposes of this document, the four probability categories are Frequent, Likely, Occasional and Seldom.

Risk: Risk is the potential for damage to, or loss of, an asset. Two factors determine the level of risk: the severity of the potential incident and the probability of the incident occurring.

Risk Management Plans (RMPs): RMPs are chemical accident prevention plans that certain facilities are required by law to file. These reports include a summary describing the facility and its processes; a worst-case accident scenario and other more likely accident scenarios; the facility's accident prevention practices; its emergency response program; a recent history of serious chemical accidents (if any); and planned improvements to safety design or operations. Facilities that submit RMPs also must describe why accidents have happened in the past and what they have done to prevent recurrences (40 CFR 68).

Roughness/Terrain: For the purposes of this document, roughness/terrain defines the land elevation and the amount of land cover used during the modeling of a scenario. Land cover includes the categories “urban” and “rural.”

Rural (Open Country): Rural means there are no buildings in the immediate area and the terrain is generally flat and unobstructed (40 CFR 68.22, 2000).

Scenario: For the purposes of this document, a scenario is a theoretical event developed for the determination of the risk level associated with a TIC/TIM release.

Seldom: It is one probability rating along an increasing scale of probability. For the purposes of this document, seldom is defined as a probability rating determined when one capability gap is identified for a release scenario.

Severity: Severity is the degree of loss or damage (monetary and non-monetary) that can be expected, or may be expected, from an intentional or unintentional event. For the purposes of this document, the four severity categories are Catastrophic, Critical, Moderate, and Negligible.

Temporary Emergency Exposure Limits (TEELs): Estimated interim concentrations that may be used to conduct appropriate emergency preparedness hazard analyses and perform consequence assessments when ERPG or AEGL values are not available for a substance. Concentrations are developed by the U.S. Department of Energy Office of Emergency Management's Subcommittee on Consequence Assessment and Protective Actions using a 15-minute exposure.

Tier II Reports: Tier II Reports are annual inventory reports that certain facilities are required by the Emergency Planning and Right-to-Know Act (EPCRA) to submit. These reports contain information on any material stored in their facility that requires an SDS and must be submitted annually to the LEPC. Some states may have other reports to meet the requirements such as California's Hazardous Materials Business Plans.

Time to Impact: The time it takes, based solely on wind speed, direction, and distance, for a chemical to be transported from the source of release to the installation perimeter.

Toxic Industrial Biologicals (TIB): Any biological material manufactured, used, transported, or stored by industrial, medical, or commercial processes which could pose an infectious or toxic threat (JP 3-11, 2013).

Toxic Industrial Chemicals (TIC): A chemical developed or manufactured for use in industrial operations or research by industry, government, or academia that poses a hazard (JP 3-11, 2013). For the purposes of this document, TIC do not include chemical compounds that are flammable/explosive but have little or no acute toxicity (e.g., propane, butane, natural gas, isopropyl alcohol, ethyl alcohol, petroleum distillates, diesel, gasoline, and jet fuel).

Toxic Industrial Materials (TIM): Toxic, chemical, biological, or radioactive substances in solid, liquid, aerosolized, or gaseous form that may be used, or stored for use, for industrial, commercial, medical, military, or domestic purposes (JP 3-11, 2013).

Toxic Industrial Radiologicals (TIR): Any radiological material manufactured, used, transported, or stored by industrial, medical, or commercial processes. Inventory and evaluate gamma-emitting TIR. Include alpha-emitting and beta-emitting TIR in the inventory but do not evaluate. Do not inventory or evaluate nuclear fuel or weapons-grade material, since they fall under the purview of the Department of Energy (DOE) (JP 3-11, 2013).

Unlikely: It is one probability rating along an increasing scale of probability. For the purposes of this document, unlikely is defined as a probability rating determined when no capability gaps are identified for a release scenario.

Urban: Urban means that there are many obstacles in the immediate area; obstacles include buildings or trees (40 CFR 68.22).

Worst-Case: For the purposes of this document, worst-case is a term used to describe the most conservative conditions that may exist and would result in the worst possible effects in the event of a substance release.

LIST OF ACRONYMS & ABBREVIATIONS

AEGL	Acute Exposure Guideline Levels
AF	Air Force
AFI	Air Force Instruction
AFMAN	Air Force Manual
AFPAM	Air Force Pamphlet
AFTTP(I)	Air Force Tactics, Techniques, and Procedures (Instruction)
AIHA	American Industrial Hygiene Association
Air-MEGs	Air Military Exposure Guidelines
AT	Antiterrorism
AT/FP	Antiterrorism/Force Protection
ATO	Antiterrorism Officer
ATWG	Antiterrorism Working Group
BE	Bioenvironmental Engineering
CAMEO	Computer-Aided Management of Emergency Operations
CBRN	Chemical, Biological, Radiological, and Nuclear
CDC	Center for Disease Control
CDX	Central Data Exchange
CE	Civil Engineering
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
Ci	Curies
CRCPD	Conference of Radiation Control Program Directors
CRED	Center for Research on the Epidemiology of Disasters
CVAMP	Core Vulnerability Assessment Management Program
DHS	Department of Homeland Security
Dir.	direction
Dist.	distance
DLIS	Defense Logistics Information System
DoD	Department of Defense
DoDD	Department of Defense Directive
DoDI	Department of Defense Instruction
DOE	Department of Energy
DOT	Department of Transportation
DTRA	Defense Threat Reduction Agency
EM	Emergency Management
EM-DAT	Emergency Events Database
EOC	Emergency Operations Center
EPA	Environmental Protection Agency

LIST OF ACRONYMS & ABBREVIATIONS (Cont'd)

EPCRA	Emergency Planning and Community Right-to-Know Act
ERPG	Emergency Response Planning Guideline
ESOH	Environmental Safety and Occupational Health
FMCSA	Federal Motor Carrier Safety Administration
FOIA	Freedom of Information Act
FOUO	For Official Use Only
FP	Force Protection
FPWG	Force Protection Working Group
GIS	Geographic Information System
Gy	Grays
HAZMAT	Hazardous Materials
HHS	Department of Health and Human Services
HMIRS	Hazardous Materials Information Resource System
HPAC	Hazard Prediction and Assessment Capability
IDLH	Immediately Dangerous to Life or Health
JP	Joint Publication
lb	pound
LEPC	Local Emergency Planning Committee
LOC	Level of Concern
MBq	Megabecquerels
MEG	Military Exposure Guidelines
MDG	Medical Group
mg	milligrams
mi	miles
min	minute
mph	miles per hour
MRC	Medical Readiness Committee
MW	molecular weight
NARA	National Archives and Records Administration
NCDC	National Climactic Data Center
NIOSH	National Institute for Occupational Safety and Health
No.	Number
NOAA	National Oceanic and Atmospheric Administration
non-OCA	non-Offsite Consequence Analysis
NRC	Nuclear Regulatory Commission
OCA	Original Classification Authority
OCDS-II	Operational Climatic Data Summary
OEH	Occupational and Environmental Health
OEHSA	Occupational and Environmental Health Site Assessment
RM	Risk Management

LIST OF ACRONYMS & ABBREVIATIONS (Cont'd)

OSI	Office of Special Investigations
POC	Point of Contact
PPE	Personal Protective Equipment
Ppm	Parts per Million
RIC	Radioisotope Committee
RM	Risk Management
RMP	Risk Management Plan
RSO	Radiation Safety Officer
SCAPA	Subcommittee on Consequence Assessment and Protective Actions
SCG	Security Classification Guide
SDS	Safety Data Sheet
SERC	State Emergency Response Commission
SF	Security Forces
SG	Surgeon General
TBq	Terabecquerels
TEEL	Temporary Emergency Exposure Limit
TG	Technical Guide
TIB	Toxic Industrial Biological(s)
TIC	Toxic Industrial Chemical(s)
TIC/TIM	Toxic Industrial Chemical/Toxic Industrial Material
TIM	Toxic Industrial Material(s)
TIR	Toxic Industrial Radiological(s)
TRI	Toxic Release Inventory
USAF	United States Air Force
USAFSAM	United States Air Force School of Aerospace Medicine
USAPHC	United States Army Public Health Center
VA	Vulnerability Assessment

APPENDIX A: CLASSIFIED MATERIAL REQUIREMENTS

Manage information in a manner consistent with its sensitivity. It is important to include the ATO/Installation Security Manager in the TIC/TIM VA process from the beginning in order to ensure proper handling of documents. BE will collect information that is sensitive due to the nature of and the risks associated with TIC/TIM during the TIC/TIM VA.

A1.0 Classification

According to Air Force Instruction (AFI) 10-245, *Antiterrorism (AT)*, and Department of Defense Instruction (DoDI) 2000.16, *DoD Antiterrorism (AT) Standards,* classify AT/FP vulnerabilities in accordance with the Defense Threat Reduction Agency *Security Classification Guide for Vulnerability Assessments* (DTRA SCG).

Identification of a vulnerability or a concern associated with a specific U.S. military site will require classification of that portion of the document as CONFIDENTIAL (C) or SECRET (S).

Identification of vulnerabilities not associated with a specific U.S. military site identified in the same report will require that portion of to be marked FOR OFFICIAL USE ONLY (FOUO). Portions of documents not identifying specific AT/FP vulnerabilities, but containing information that if released to the public could be exploited (e.g., facility data, TIC/TIM inventory, TIC/TIM location map) will be marked FOUO.

Sections or paragraphs containing unclassified information should be marked UNCLASSIFIED (U). Follow the same procedures for briefings.

Based on the latest guidance, it is recommended that the overall TIC/TIM VA report be marked SECRET (S).

The classification of the overall TIC/TIM VA report as SECRET is based on the evaluation of the individual components of the report. Several sections of the report were deemed to require CONFIDENTIAL or SECRET classification; therefore, the more conservative classification was selected for the overall report classification. The following components were determined to be vulnerabilities or observations that would require a level of classification of CONFIDENTIAL or SECRET:

1. Calculations, impact determination of hazard zones, including release volume, distance, direction, buildings impacted, and time to impact;
2. ORM determination, including source, TIC/TIM identification, release scenario, release severity rating, release probability, and release risk level; and

3. Recommendations and conclusions related to installation vulnerabilities.

The following additional components of the TIC/TIM VA report were determined to contain sensitive information that would require a level of classification of FOUO:

1. Facility data, including building numbers, identifications, and sizes;
2. TIC/TIM inventory, including source, TIC/TIM identification, ownership, quantity, type of storage, and distance to installation and/or onsite populations;
3. Additional information (e.g., methodologies, assumptions) specific to on-base TIC/TIM; and
4. Maps displaying TIC/TIM locations relative to the installation.

A2.0 Marking and Handling

The DTRA SCG for Vulnerability Assessments provides specific guidance for marking classified materials relating to vulnerability assessments (e.g., reports, field-notes, handouts). Vulnerability assessment report developers should confer with the original classification authority (OCA) assigned to their unit for additional direction.

AFI 31-401, *Information Security Program Management*, provides general guidance on the marking and handling of classified materials. DoD 5200.1-PH, *DoD Guide to Marking Classified Documents* provides more specific guidance and examples for marking classified national security information, including the marking of individual paragraphs and pages. Specific guidance concerning handling, safeguarding, transport, declassification and downgrading, destruction or administration of classified material is available in DoD 5200.1-R, *Information Security Program;* DoD 5220.22M, *National Industrial Security Program Operating Manual* and all references identified in these and subsequent documents. Check with the unit security manager and appropriate unit operating instructions for additional information.

A3.0 Foreign Disclosure

Classified information may be released to the host country on a "need-to-know" basis when it directly affects an organization's ability to implement the antiterrorism program or correct noted deficiencies identified during a vulnerability assessment. Classified information that may be released or shared with the host country will be authorized and processed as described in DoDD 5230.11, *Disclosure of Classified Military Information to Foreign Governments and International Organizations*, and National Disclosure Policy-1 (NDP-1), *National Policy and Procedures for Disclosure of Classified Military Information to Foreign Governments and International Organizations*. DoD 5200.1-R provides provisions for the transfer of classified information that has been approved for release to a foreign country.

APPENDIX B: OVERSEAS TIC/TIM DATA COLLECTION

B1.0 About

The Final Overseas Supplement provides additional sources of information for identification of TIC/TIM sources overseas and guidance for overseas bases on best practices to conduct TIC/TIM assessment. Those resources are the compilations of information obtained from BE stationed overseas and the Army Public Health Commands.

B2.0 On Base Resources

Base Safety, medical Logistics, Public Health, Defense Occupational Environmental Health Readiness System (DOEHRS), Base EPCRA POC, Security Forces, Base Weather, Base Real Property Manager, Base Contracting, Installation Radiation Safety Officer (RSO), Antiterrorism Officer (ATO), Office of Special Investigations (OSI), and Google Earth

B3.0 Off Base Resources

- **Control of Major Accident Hazards (COMAH)** regulations are UK programs, equivalent to the USA TIER 1&2, aimed at preventing and managing major accidental release of TIC/TIM. COMAH has limited listing of TIC/TIM resources; BEEs may need to contact the local Health and Safety Executive to obtain additional TIC/TIM information. http://www.hse.gov.uk/comah/

- **Defense Intelligence Agency (DIA)** provides military intelligence to warfighters, defense policymakers and force planners in the Department of Defense and the Intelligence Community, in support of U.S. military planning and operations and weapon systems acquisition during peacetime, crisis, and war. http://www.dia.mil/

- **Department of Homeland Security (DHS)** was created to protect the American people from terrorist threats. DHS teams up with OSHA and law enforcement agencies to identify and prevent terrorist's use of high-risk TIC/TIM storage facilities to cause deaths and injuries. http://www.dhs.gov/topic/chemical-security

- **Homeland Infrastructure Foundation (HIFLD)** is a homeland security database that collects, processes, shares, and maintains all homeland infrastructure

geospatial information across multiple levels of government to include information on TIC/TIM infrastructures located overseas. https://gii.dhs.gov/HIFLD/

- **Host Nation Coordination Office and EMDG Host Nation Representative** are the focal points for getting off-base TIC/TIM information and coordinating visits to locals industries.

- **National Center for Medical Intelligence (NCMI)** Environmental Health monitors potential toxic chemical release, radiation accidents, microbial contamination, and environmental terrorism that may pose health threats to the armed force personnel. NCMI is a viable source for TIC/TIM information overseas. https://www.ncmi.detrick.army.mil/

- **National Geospatial-Intelligence Agency (NGA)** combines the intelligence agency and combat support agency to analyze, exploit, process and depict imagery of physical features and geospatial information useful to decision makers, warfighters, and first responders. https://www.nga.mil/

- **The National Production Workshop (NPW)** is a classified database used by the USARMY PHC to identified overseas industries within a radius of interest.

- **Military Exposure Surveillance Library (MESL)** allows access to OEHS data like Pre-deployment Site Surveys, Basecamp Assessments, Analytical Summaries, After Action Reports, Preventive Medicine Reports, Industrial Hygiene Assessments, Food and Water Health Risk Assessments https://mesl.apgea.army.mil/mesl/index.jsp

- **USAPH: Environmental Medicine Program (EMP)** provides medical and epidemiological expertise in the evaluation and communication of the health impacts of environmental exposures to Soldiers, their family members, and DOD civilians in deployed and garrison settings. Exposures of recent concern include particulate matter and dust, burn pit smoke, and other ambient contaminants, such as those in air, soil, water, as well as unique incidents involving certain chemical, biological, radiological (CBRN), and toxic industrial chemical (TIC) hazards. http://phc.amedd.army.mil/organization/hq/doem/Pages/EnvMed.aspx

- **USAPH Pacific: Field Preventive Medicine** provides Environmental Site Assessments, Medical Threat Briefings, Consultation services and Deployment Occupational and Environmental Health (DOEHS) Training on air, water, soil,

entomology, industrial hygiene to all military components in the Pacific Command (PACOM) region. http://phc.amedd.army.mil/organization/phcrpac/hrm/Pages/FieldPreventiveMedicine.aspx

- **Special Medical Response Capability-Public Health (SMRC-PH)** is a humanitarian disaster relief team that deploys year round and performs field analysis of disease transmission vectors; environmental toxins; production and manufacturing facilities, nuclear reactors, or other industrial operations; and potential CBRNE hazards. Further, SMRC-PH provides consequence management support to include health hazard identification, health risk assessment and consultation, environmental health surveillance, public health hazard control planning and reach back laboratory sample analysis. http://phc.amedd.army.mil/organization/phcrpac/Pages/SpecialMedicalResponseCapability-PublicHealth.aspx

- **U.S. Embassies** play a pivotal role in counterterrorism efforts. They serve as the locus for coordinating the critical elements of national power: diplomacy, economic strength, law enforcement, intelligence and military might. Embassies also play a decisive role in fostering cooperation with partner nations and are a focal point for providing training to bolster the counterterrorism capabilities of these countries. http://www.usembassy.gov/

APPENDIX C: LEVELS OF CONCERN (LOC)

LOCs for toxic chemicals are "threshold concentrations," at or above which individuals may experience specific harmful effects. The TIC/TIM VA methodology uses the following three LOCs based on the effects of chemicals on individuals:

- LOC_1 – The threshold concentration at or above which may cause minor injury/illness or non-negligible impacts.
- LOC_2 – The threshold concentration at or above which may cause severe injury/illness.
- LOC_3 – The threshold concentration at or above which may cause death.

Acute Exposure Guideline Levels (AEGLs), Emergency Response Planning Guidelines (ERPGs), and Temporary Emergency Exposure Limits (TEELs) are data sources for TIC concentrations that relate to the three LOCs.

Note that there are subtle differences in the definitions of AEGLs, ERPGs, and TEELs:

- AEGLs are the concentration levels above which certain health effects are expected.
- ERPGs and TEELs are the maximum concentration level below which certain health effects are *not* expected. The discussion in the subsequent subsections will further elucidate this point and provide additional information on how each exposure guideline value corresponds to an LOC.

In deployed settings only, the U.S. Army Air Military Exposure Guidelines (Air-MEGs) should be used. These values are developed by the USAPHC and are based on a continuous, single exposure of specified duration.

To facilitate the use of the proper LOC values, DOE's Office of Emergency Management's Subcommittee on Consequence Assessment and Protective Actions (SCAPA) maintains a Protective Action Criteria (PAC) dataset that includes AEGL, ERPG, and TEEL values for over 3,200 chemicals. DOE SCAPA developed the methodology for deriving TEELs, which may be used until peer-reviewed AEGLs or ERPGs are developed. When AEGLs or ERPGs are developed for new substances, the new AEGLs and ERPGs supersede TEELs.

The threshold concentrations that determine LOCs are listed in the following guidelines.

C1.0 Acute Exposure Guidelines

The EPA AEGL Committee develops AEGLs for short-term exposures of almost 300 high-priority hazardous substances. AEGLs estimate the concentrations at which most people—including sensitive individuals such as old, sick, and very young people—will begin to experience health effects if exposed to a toxic chemical for a specific length of time. AEGLs are developed for each of five exposure periods: 10 minutes, 30 minutes, 60 minutes, 4 hours, and 8 hours.

The AEGL Committee's guidelines have defined three different health effect endpoints, which include the following (definitions obtained from EPA's AEGL Program website http://www.epa.gov/oppt/aegl/):

- **AEGL-1:** "*The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic, non-sensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.*" AEGL-1 corresponds to threshold concentration LOC_1.

- **AEGL-2:** "*The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.*" AEGL-2 corresponds to threshold concentration LOC_2.

- **AEGL-3:** "*The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.*" AEGL-3 corresponds to threshold concentration LOC_3.

While there are multiple time-based, exposure values for AEGLs, for the purposes of the TIC/TIM VA methodology, only the one-hour exposure periods are used.

C2.0 Emergency Response Planning Guidelines

The AIHA develops the ERPG's using toxicological, physical, and chemical properties for emergency planning to forecast potential health effects caused by exposure to toxic chemicals. These values are assigned by a committee of experts who assign these values and update them annually. The ERPGs provide guidance on one-hour exposure periods only and may not accurately reflect the health effects for hypersensitive individuals.
There are three concentration guideline levels developed by the AIHA for each chemical, which include the following (definitions obtained from AIHA website):

- **ERPG-1**: "*The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing other than mild, transient adverse health effects or without perceiving a clearly defined objectionable odor*." ERPG-1 corresponds to threshold concentration LOC_1.

- **ERPG-2**: "*The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action*." ERPG-2 corresponds to threshold concentration LOC_2.

- **ERPG-3**: "*The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing life-threatening health effects*." ERPG-3 corresponds to threshold concentration LOC_3.

Obtain the most current ERPG values from the AIHA website https://www.aiha.org/Pages/default.aspx. Over 120 chemicals have been assigned ERPG values.

C3.0 Temporary Emergency Exposure Limits

The Department of Energy (DOE) Office of Emergency Management's Subcommittee on Consequence Assessment and Protective Actions (SCAPA) developed TEELs so that DOE facilities could conduct appropriate emergency preparedness hazard analyses and perform consequence assessments for the thousands of chemicals lacking AEGLs or ERPGs. TEELs are potential values and are subject to change whenever new or better information becomes available.

Similar to AEGLs and ERPGs, three concentration guideline levels have been developed for TEELs. These three levels include the following (definitions obtained from SCAPA website):

- **TEEL-1**: "*The maximum airborne concentration below which it is believed that nearly all individuals could be exposed without experiencing other than mild transient adverse health effects or perceiving a clearly defined, objectionable odor.*" TEEL-1 corresponds to threshold concentration LOC_1.

- **TEEL-2**: "*The maximum airborne concentration below which it is believed that nearly all individuals could be exposed without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action.*" TEEL-2 corresponds to threshold concentration LOC_2.

- **TEEL-3**: "*The maximum airborne concentration below which it is believed that nearly all individuals could be exposed without experiencing or developing life-threatening health effects.*" TEEL-3 corresponds to threshold concentration LOC_3.

TEEL concentrations assume a 15-minute period of exposure. Currently, approximately 3,000 chemicals have TEEL values. TEELs, AEGLs and ERPGs are listed in SCAPA's PAC dataset. This dataset can be found at the following DOE Office of Health, Safety, and Security website. Find additional information on TEEL values at the SCAPA website http://orise.orau.gov/emi/scapa/chem-pacs-teels/.

C4.0 Military Exposure Guidelines (MEGs)

Deployed settings offer different types of scenarios than releases on fixed Air Force bases or within close proximity of an Air Force base. The USAPHC *Technical Guide 230* defines MEGs as "*concentrations of chemicals in air, water and soil that are designed as decision aids for health risk assessors to evaluate the significance of field exposures to chemical hazards during deployment.*" Inhalation of contaminated air offers the most likely method of exposure to toxic chemicals in deployed settings.

MEGs specifically related to inhalation of chemicals are referred to as Air-MEGs. Exposure to air contamination is difficult to avoid or to control, and thus, the military developed a variety of Air-MEGs, based on existing criteria (e.g. exposure guidelines and toxicological estimates), to simulate a wide variety of possibilities for planning purposes. USAPHC has developed Air-MEGs for both short-term and long-term exposure durations. Short-term exposure durations for chemicals other than chemical warfare agents include durations of one hour, eight hours, and 14 days. For chemical warfare agents, short-term exposure durations include periods of 10 minutes, one hour, eight hours, and 24 hours. Long-term exposure considers continuous exposure to chemical concentrations for a period of one year. Consider only the short-term, one hour, Air-MEG exposures during this assessment (similar to one-hour exposure times used for AEGL and ERPG values).

Air-MEGs have four different health effect endpoints, which include the following (definitions obtained from TG 230):

- **10-minute, 1-hour, 24-hour Catastrophic Air-MEG: "***A continuous exposure to airborne concentrations (for 10 minutes, one hour, or 24 hours) above the MEG is anticipated to result in deaths and/or many personnel with severe incapacitating effects (overall greater than 50 performance mission/performance capability loss). Effects are likely to require medical treatment.*"

- **10-minute, 1-hour, 24-hour Critical Air-MEG:** "*A continuous exposure to airborne concentrations (for 10 minutes, one hour, or 24 hours) above the MEG (but below the Catastrophic MEG) could begin to result in serious health effects. This MEG is a conservative population threshold estimate of potential life-threatening or lethal effects; whereby, these effects are expected initially in personnel with underlying susceptibility factors". "*

- **10-minute, 1-hour, 24-hour Marginal Air-MEG**: "*A continuous exposure to airborne concentrations (for 10 minutes, one hour, or 24 hours) above the MEG (but below the Critical MEG) could begin to produce effects that may result in some performance degradation, especially for tasks requiring extreme mental/visual acuity or physical dexterity/strength amongst a portion of individuals."*

- **10-minute, 1-hour, 24-hour Negligible Air-MEG:** "*A continuous exposure to airborne concentrations (for 10 minutes, one hour, or 24 hours) above the MEG (but below the Marginal MEG) could begin to produce mild, non-disabling, transient, reversible effects. Such effects, if any, will be typically mild irritant types of effects and/or initially be expected in personnel with underlying susceptibility factors (e.g. asthmatics). Effects are not expected to impair performance."*

A complete list of Air-MEGs is in USAPHC *TG 230*, Appendix C.

C5.0 Radiation Material LOCs

LOCs for gamma-emitting radiation are absorbed dosage levels expressed in units of Gy. For all gamma-emitting radioactive materials:

- Zone 1 (LOC_3) is an area where absorbed dosages exceed 3.0 Gy over a one-hour period.
- Zone 2 (LOC_2) is an area where absorbed dosages exceed 1.5 Gy over a one-hour period.
- Zone 3 (LOC_1) is an area where absorbed dosages exceed 0.35 Gy over a one-hour period.

These absorbed dosage values are based on a review of recommendations provided by the National Council on Radiation Protection and Measurements (2001).

Calculate the distances for each of the three hazard zones based on the type and quantity (activity) of the gamma-emitting radioactive material. The three zone distances are calculated using the following equation (derived from Radiological Health Handbook (1970); the Handbook of Radiological Protection (1971); and Radioisotopes in Biology (2002)):

Equation: $d_{1,2,3} = 3.28*(k*A*t/LOC_{3,2,1})^{0.5}$

Where:

$d_{1,2,3}$ = Distance to absorbed dosage level for each zone [i.e., distance to maximum extent of the zone] (in ft)
3.28 = Conversion factor (from meters to ft)
k = Gamma Ray Constant

- for Actinum-227, k = 5.95×10^{-8} Gy m^2/MBq hr
- for Cesium-137, k = 8.92×10^{-8} Gy m^2/MBq hr
- for Cobalt-60, k = 3.57×10^{-7} Gy m^2/MBq hr
- for Iridium-192, k = 1.30×10^{-7} Gy m^2/MBq hr
- for Radium-226, k = 2.23×10^{-7} Gy m^2/MBq hr
- for Selenium-75, k = 5.41×10^{-8} Gy m^2/MBq hr
- for Thulium-170, k = 6.76×10^{-10} Gy m^2/MBq hr

A = Activity of the radioactive source measured in MBq; if activity is reported in Ci, use 1 Ci = 3.7×10^4 MBq
t = Exposure time (hr); 1 hour is assumed in this method
$LOC_{3,2,1}$ = Absorbed dose limit (Gy);

- for Zone 1, LOC_3 = 3.0 Gy
- for Zone 2, LOC_2 = 1.5 Gy
- for Zone 3, LOC_1 = 0.35 Gy

APPENDIX D: RMP*COMP

RMP*Comp is an online planning tool developed by NOAA and the EPA to help facilities identify high priority hazards located at their facilities. RMP*Comp will estimate a "Toxic Endpoint" to a distance of 25 miles (40km). BE can use RMP*Comp to help determine the potential risk associated with a TIC/TIM release from a facility identified during the TIC/TIM VA process.

Upon identification of a facility and the quantity of the TIC onsite, use RMP*Comp to determine the estimated distance a release will travel. Based on the data collected during the TIC/TIM VA, BE will be able to determine if a release at each facility has the potential to affect the installation.

RMP*Comp is designed for use by individual facilities. The owner/operator at a facility can input the quantity of the RMP-regulated chemical(s) that they use or store onsite. RMP*Comp will make simple calculations to determine the distance a toxic release will travel and help to identify the area potentially impacted by a release of that chemical. It uses preset parameters for the meteorological conditions:

Meteorological for Worst-Case Scenarios:

- Wind Speed: 1.5 meters/second (3.4 miles/hour)
- Stability Class: F
- Air Temperature: 77 degrees F (25 degree C)
- Toxic Endpoint is ERPG -2
- 10-minute release

For Worst-Case Scenarios the user will select:

- Chemical – choose from the list in RMP*Comp
- Scenario Type – select either worst-case
- Quantity Released, (and have the option to select units as well)
- Surrounding Terrain Type (urban or rural)
- Liquid Temperature (for some chemicals, not an option for all)
- Mitigation Measures, (options being Release into diked area or release into building)

RMP*Comp does not provide distances for all three LOC's as plume modeling does. It simply provides an estimated distance to toxic endpoint, which is based on ERPG 2. To assess the severity of a potential release, run up to three scenarios for each TIC.

To use RMP*Comp click on Begin online at:
https://cdxnodengn.epa.gov/cdx-rmp-maintain/action/rmp-comp

Figure D-1. RMP*Comp

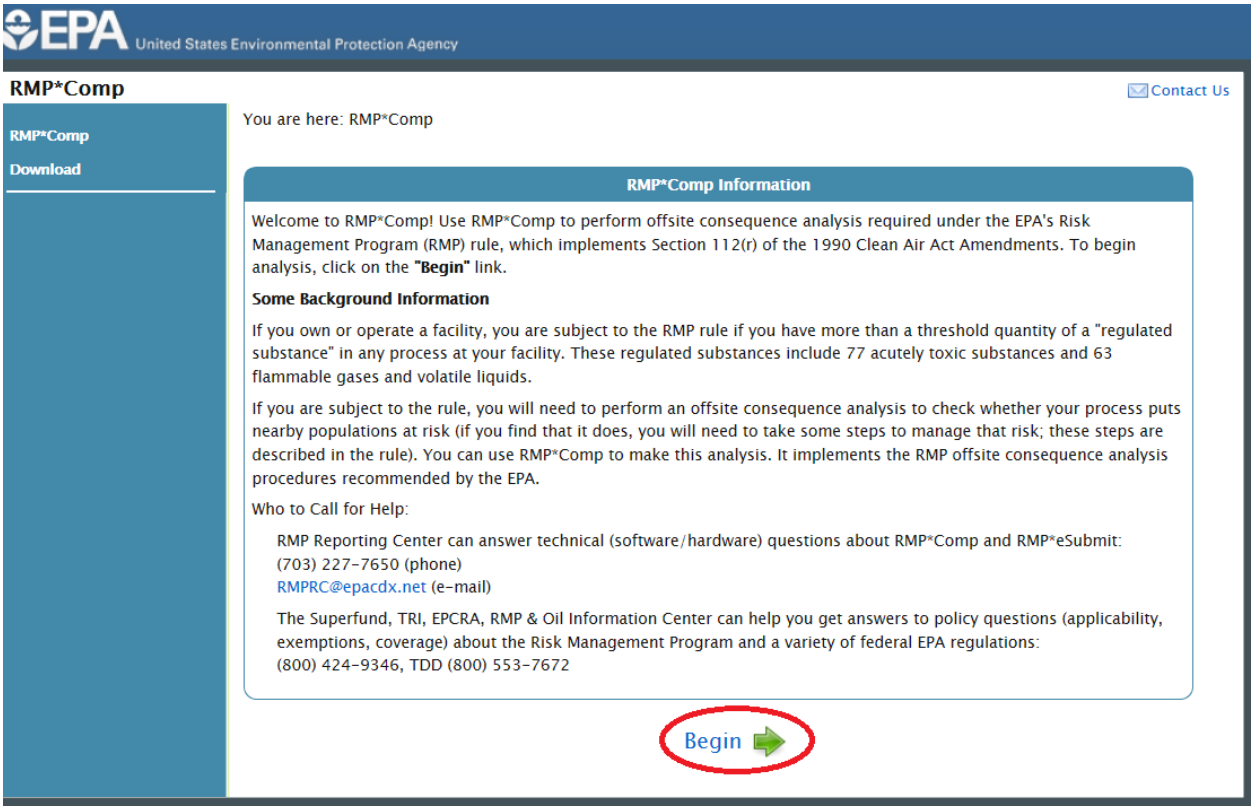
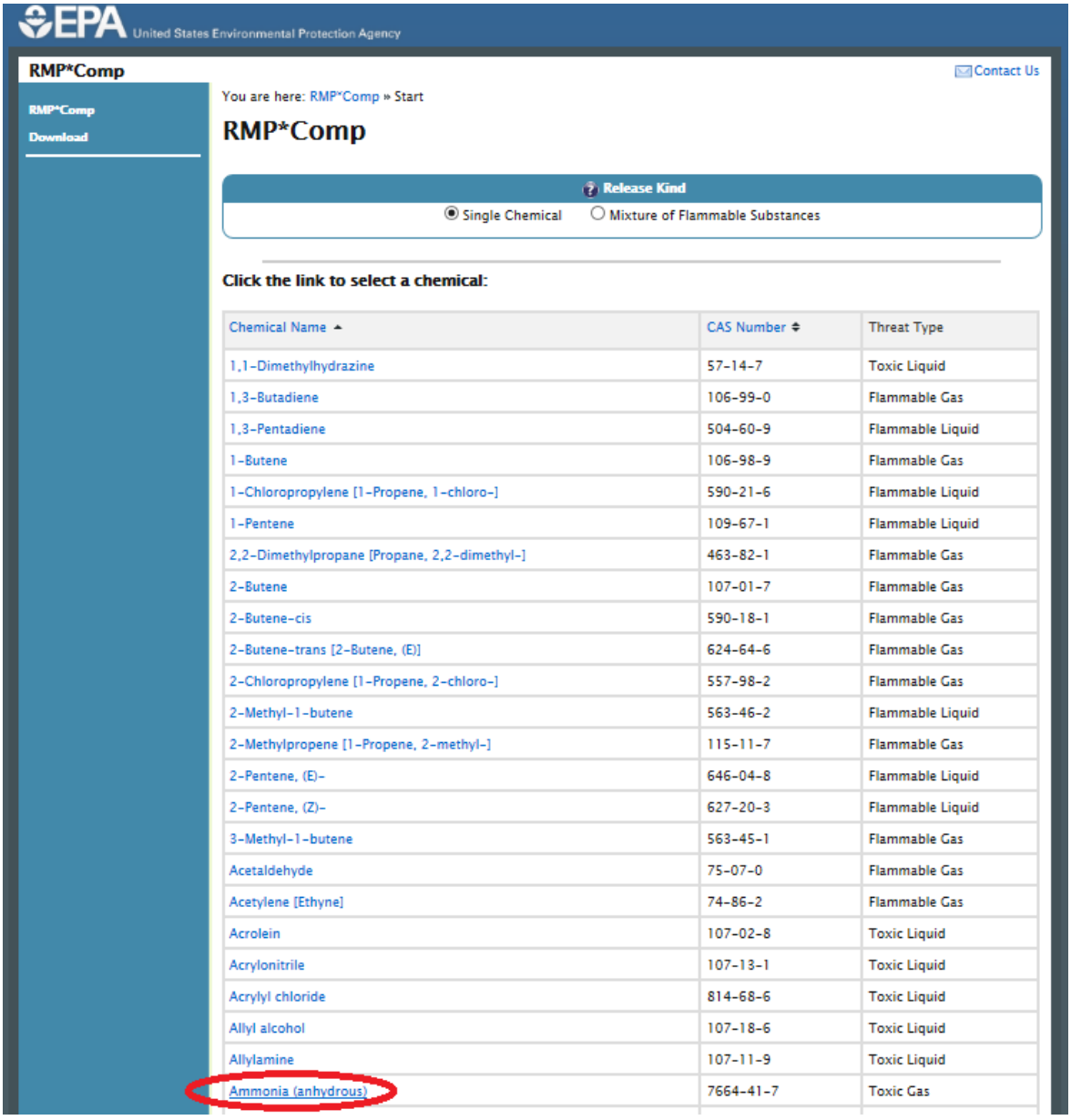
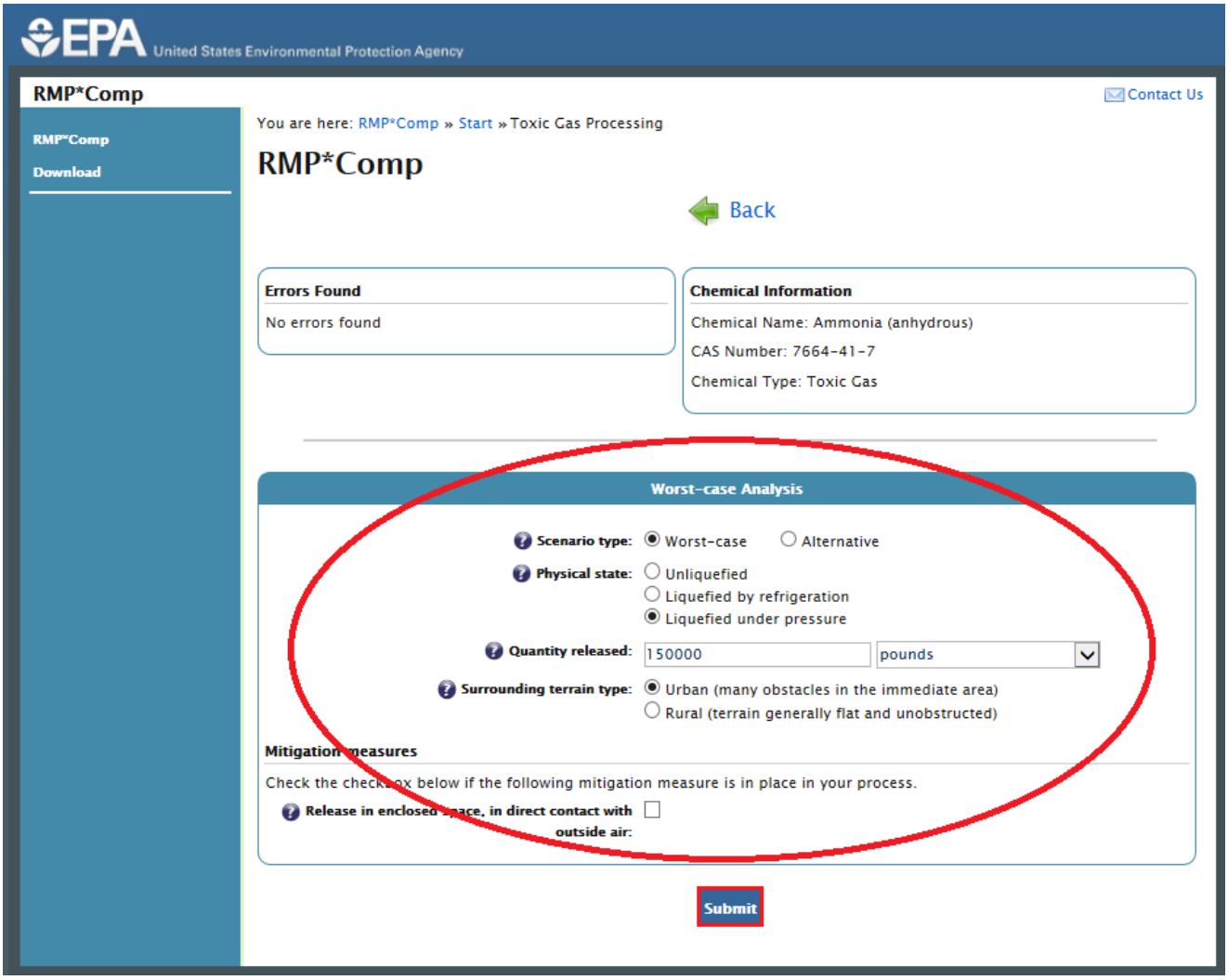


Figure D-2. RMP*Comp Chemical List



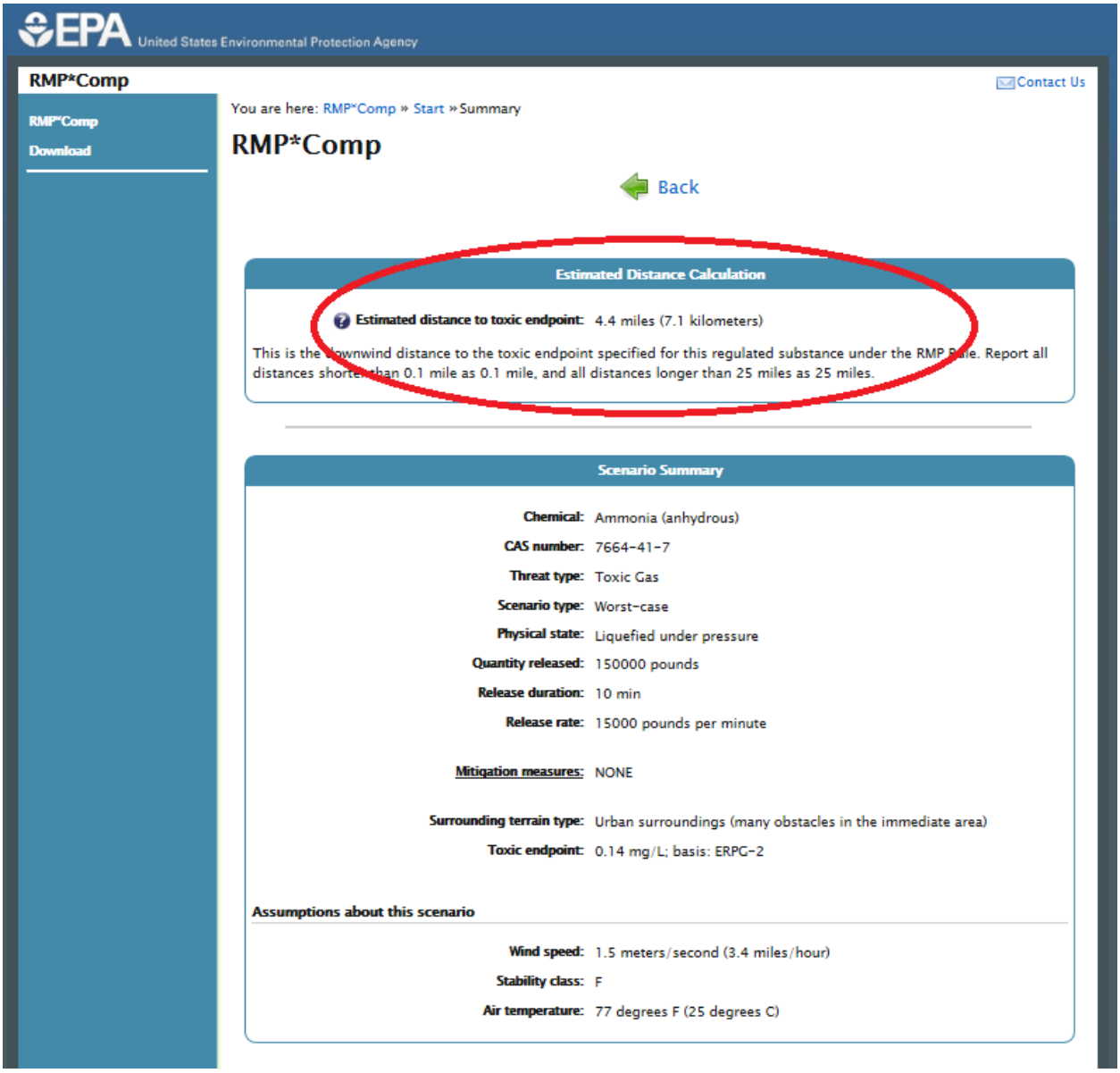
Select the chemical of concern and complete the form on the following page. Select only worst-case for scenario type, physical state (if required), and quantity released from the data collected, select the surrounding terrain type (select the most applicable to the area). Select any mitigation measures (if known) and click submit.

Figure D-3. RMP*Comp Worst-Case Analysis Screen



Select Submit and RMP*Comp will calculate the estimated distance to toxic endpoint, based on the quantity and parameters selected.

Figure D-4. RMP*Comp Estimated Distance Calculation Screen



Compare the estimated distance to toxic endpoint calculated by RMP*Comp to the distance from the installation in the comprehensive TIC/TIM inventory, to determine if the release has the potential to affect the installation. If the estimated distance to toxic endpoint will reach the installation, repeat the steps outlined above using two-thirds of the maximum quantity onsite for the selected facility. If the estimated distance to toxic endpoint reaches the installation for the second scenario (two-thirds of the maximum quantity), then repeat a third time using one-third of the maximum quantity onsite. Again, use the estimated distance to toxic endpoint to determine if the release scenario will reach the installation.

Use the results to determine the severity level of a release at the selected facility.

The following guidelines are provided for determining severity ratings for each TIC/TIM release:

- If the estimated distance to toxic endpoint for all three scenarios will reach the installation, the severity level is "Catastrophic."

- If the estimated distance to toxic endpoint for scenarios 1 and 2 will reach the installation, the severity level is "Critical."

- If the estimated distance to toxic endpoint for only scenario 1 will reach the installation, the severity level is "Moderate."

- If the base is located beyond the estimated distance to toxic endpoint for all three scenarios, the severity level is "Negligible."

APPENDIX E: TIC/TIM VULNERABILITY ASSESSMENT WORKBOOK

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ABOUT THIS WORKBOOK

AFI 41-106, *Unit Level Management of Medical Readiness Programs*, provides procedures for medical readiness planning and training for wartime, humanitarian assistance, homeland security/defense, and disaster response contingencies. Per AFI 10-245, BE is required to conduct an annual assessment of local industrial facilities (on- and off-base) that may be of consequence to base operations if a TIC/TIM is released. It also states that assessment information should be reported to the Medical Readiness Committee (MRC), the Antiterrorism Working Group (ATWG) (also known as the Force Protection Working Group [FPWG]), and the Executive Management Committee (EMC). Also, the BE Technician is to provide the Public Health Emergency Officer (PHEO) with threat assessment information necessary for planning the clinical response to a CBRN event.

This TIC/TIM VA Workbook was developed to support the implementation of the assessment outlined in the *Bioenvironmental Engineering Guide to Toxic Industrial Chemical/Toxic Industrial Material (TIC/TIM) Vulnerability Assessment.* The workbook provides assessors with a convenient and consistent way to document their results, and it includes blank forms and instructions for completing the forms.

Form 1-1: Stakeholders Listing

Instructions for Completing Form 1-1:

Organization: The organization of the stakeholder. Organizations which are typically contacted are already inserted in the document; additional organizations may be listed as applicable.

POC(s): Point of contact for each organization. Listing the name of the POC will document who was contacted for the corresponding information.

DSN/COM: Phone numbers for the POC.

Email Address: Email address for the POC.

Form 1-1 Stakeholders Listing

TIC/TIM VA Stakeholders			
Organization	**POC(s)**	**DSN/COM**	**Email Address**
Bioenvironmental Engineering (BE)			
Radiation Safety Officer (RSO)			
Antiterrorism Officer (ATO)			
Office of Special Investigation (OSI)/Intel			
Security Force			
CE – Emergency Manager			
CE - LEPC Representative			
CE - EPCRA POC			
CE - Fire Department POC			
CE - Pest Management			
CE - GeoBase POC			
CE - Hazardous Waste Program Manager			
CE - Real Property Officer			
CE – Environmental Manager			
Hazardous Material Pharmacy Manager			
Safety Office			
Weather Office			
Public Health			
Contractor Support			
Off-Base LEPC Representative*			
Off-Base SERC Representative*			
Railroad Company Environmental Safety Officer*			

*There may be multiple POCs

Form 1-2: Meteorological Data Worksheet

Instructions for Completing Form 1-2:

See Section 2.6 of the main document for more information on how to retrieve Meteorological Conditions. Note, in modeling, rural is sometimes also referred to as open country.

Worst-Case Scenario parameters (used by RMP*Comp) per 40 CFR Section 68.22:

- Wind Direction: Worst-Case Scenario wind direction should be assumed as pointing toward the installation (i.e., coming from the direction of the source).
- Wind Speed: Worst-Case Scenario wind speed is 3.4 mph.
- Temperature: Worst-Case Scenario temperature is 77˚F.
- Stability Class: Worst-Case Scenario stability class is F.
- Roughness: Sometimes referred to as the Surface Roughness or Ground Roughness, there are two options for Roughness, Urban or Rural. Per 40 CFR Section 68.22, "Urban means that there are many obstacles in the immediate area; obstacles include buildings or trees. Rural means there are no buildings in the immediate area and the terrain is generally flat and unobstructed. The actual conditions should be used; however, rural conditions may be used as a conservative estimate.

Table 4. Worst-Case Meteorological Data

Condition	Worst-Case
Wind Direction	Towards Installation
Wind Speed (mph)	**3.4**
Temperature (˚F)	**77**
Stability Class	**F**
Roughness	Rural/Open Country

Form 1-2 Meteorological Data Worksheet

Condition	Value
Wind Direction	
Wind Speed (mph)	
Temperature (˚F)	
Stability Class	
Roughness	

Table 5. Meteorological Conditions Characterized by Pasquill Stability Classes

WIND SPEED		DAYTIME SOLAR RADIATION			NIGHTTIME CLOUD COVER	
meters/second	**miles/hour**	**strong**	**moderate**	**slight**	**> 50%**	**< 50%**
< 2	< 5	A	A–B	B	E	F
2–3	5–7	A–B	B	C	E	F
3–5	7–11	B	B–C	C	D	E
5–6	11–13	C	C–D	D	D	D
> 6	> 13	C	D	D	D	D

Form 1-3: Toxic Industrial Chemicals/Toxic Industrial Materials (TIC/TIM) Inventory

Instructions for Completing Form 1-3:

Classify this form as "FOUO," at a minimum, once information is entered.

General Instructions: Gather the information to complete this form relating to on-base TIC/TIM from the site hazardous materials database. Gather the information relating to offsite TIC/TIM from the Local Emergency Planning Committee (LEPC), State Emergency Response Commission (SERC), Transportation POC(s), RMP, etc.

No.: Numeric identifier, which can be used to reference the TIC/TIM.

TIC/TIM Name: Identify the TIC/TIM chemical stored. Use the chemical name whenever possible.

Facility/Location: Include the company name and address.

Emergency Contact: At a minimum, this should include an emergency phone number for the facility. Add the name of the facility's Emergency POC, if desired.

Lat/Long: Indicate the latitude and longitude where the TIC/TIM is stored. Sometimes the location given for the TIC/TIM might not be where the TIC/TIM is actually stored. For instance, the location given might be the headquarters of the company. For this reason, it is important to follow up and contact these organizations to insure that information is accurate.

Container:

- **Type:** Identify the type of storage (e.g., steel drum, cylinder, tank, railcar)
- **Size:** Indicate size of the container (e.g., 55-gallons)
- **No.:** Indicate the number of containers for the TIC/TIM

Max. Quantity: Indicate the maximum quantity or volume of chemical stored onsite.

Dist/Dir from Base: Note the distance from the TIC/TIM to the nearest fence line of the installation, as well as the direction the TIC/TIM is located from the installation. Notate this direction in relation to the installation (i.e., if the TIC/TIM is 1.5 miles south of the base, the input should be "1.5/S"). If using a Geographic Information System (GIS) map/imagery tool such as Google Earth™, enter the exact direction from the installation (1.5/183.5°).

Notes: Include any notes about the TIC/TIM that may be useful. For instance, some locations may have the same type of TIC/TIM (e.g. chlorine) stored in multiple locations. The note might state that there are 5,000 lbs. of chlorine at the location, even though this entry is only inventorying 500 lbs. of it.

Form 1-3 Toxic Industrial Chemicals/Toxic Industrial Materials (TIC/TIM) Inventory

No.	TIC/TIM Name	Facility/Location	Emergency Contact	Lat./Long.	Container			Max. Quantity (lbs)	Dist./Dir. from Base (mi)	Notes:
					Type	Size	No.			

Form 1-4: Levels of Concern (LOCs)

Instructions for Completing Form 1-4:

Include a completed version of this form in the TIC/TIM VA Report to demonstrate the LOC values used to complete the TIC evaluations.

General Instructions: Appendix B demonstrates a way to determine the LOC for each TIC or TIR.

TIC/TIR: Identify the TIC/TIR. Use the chemical name whenever possible.

LOC Source: List the source of the LOC (i.e., AEGL, ERPG, TEEL, MEG).

Values:

- **LOC 3:** This value may be determined using the method described in Appendix B
- **LOC 2:** This value may be determined using the method described in Appendix B
- **LOC 1:** This value may be determined using the method described in Appendix B

Form 1-4 Levels of Concern (LOCs) Table

TIC/TIR	LOC Source	Values (ppm)		
		LOC_3 (Zone 1)	LOC_2 (Zone 2)	LOC_1 (Zone 3)

Form 1-5: TIC/TIM Inventory Hazard Zones

Instructions for Completing Form 1-5:

Completing this form will result in the form being classified SECRET because actual base vulnerabilities are being listed. Therefore, this information should be marked and stored accordingly. Insert a completed version of this form into the TIC/TIM VA Report to detail the results of the TIC/TIM evaluations.

TIC/TIM No.: Numerical identifier for each TIC/TIM. This number should correspond to the number used in Form 1-3.

TIC/TIM Name: Use chemical or radioisotope name whenever possible.

Quantity: The quantity, in pounds for TIC and in Gy for TIR.

Zone (1, 2, and 3): These are the hazard zones corresponding to the appropriate LOC (i.e. within Zone 1, the concentration is equal to or less than LOC_3).

Distance to Base: The distance from the location of the TIC/TIM to the base along the path of the wind direction.

Estimated distance to toxic endpoint: The estimated distance the toxic area of a TIC/TIM release will travel as calculated by RMP*Comp.

Time to Impact: The time for the TIC/TIM to first impact the installation. Note that this calculation uses wind speed (RMP*Comp uses 3.4 mph) and the distance to the closest point on the installation from the TIC/TIM release (i.e. this is the time it would take the wind to get to the base).

Form 1-5 TIC/TIM Inventory Hazard Zones

TIC/ TIM No.	TIC/TIM Name	Quantity (lb or Gy)	Estimated distance to toxic endpoint or LOC 1 (mi)	Estimated distance to toxic endpoint or LOC 2 (mi)	Estimated distance to toxic endpoint or LOC 3 (mi)	Distance to Base (mi)	Time to Impact Base (min)

Form 1-6: Risk Table

Instructions for Completing Form 1-6:

Completing this form will result in the form being classified SECRET because actual base vulnerabilities are being listed. Therefore, this information should be marked and stored accordingly. Insert a completed version of this form into the TIC/TIM VA Report to detail the results of the TIC/TIM evaluations. Terms used in the Form 1-6 Risk Table are described here.

TIC/TIM No.: Numerical identifier for TIC/TIM. This number should correspond to the number used in Form 1-3.

Facility: The name of the facility where the TIC/TIM is stored.

Chemical: The chemical name of the TIC/TIM (i.e., Ammonia, Chlorine, etc.)

Severity: The severity of the scenario per Section 3.4.1. The severity of a release depends on the impact to the installation. Using the RMP*Comp tool, assessors may need to perform as many as three scenarios for each TIC/TIM identified in the data gathering process.

- Scenario 1 - enter the entire quantity reported by the facility into RMP*Comp. If the estimated distance to toxic endpoint determines that a release will reach the installation, perform a second scenario.

- Scenario 2 - enter two-thirds of the quantity reported by the facility into RMP*Comp. If the estimated distance to toxic endpoint determines that a release will reach the installation, perform a third and final scenario.

- Scenario 3 - enter one-third of the quantity reported by the facility into RMP*Comp.

The following provides guidelines for determining severity level ratings for each TIC/TIM release:

- If the estimated distance to toxic endpoint for all three scenarios will reach the installation, then the severity level is "Catastrophic."

- If the estimated distance to toxic endpoint for scenarios 1 and 2 will reach the installation, then the severity level is "Critical."

- If the estimated distance to toxic endpoint for only scenario 1 will reach the installation, then the severity level is "Moderate."

- If the base is located beyond the estimated distance to toxic endpoint for all three scenarios, then the severity level is "Negligible."

Probability: The probability of the scenario per Section 6.2.2.

During the TIC/TIM VA process, assessors may identify capability gaps based on the TIC/TIM identified in the area surrounding the installation. The more capability gaps identified, the more likely it is that a release will impact the installation. These capability gaps include, but are not limited to:

- The installation does not have the proper equipment to detect exposure levels to the specific TIC assessed at or below a threshold level deemed dangerous.

- The installation does not have the proper PPE to protect personnel against the TIC/TIM assessed. For example, during the assessment, assessors may discover that a new distribution center moved into the area and they have a large quantity of ammonia onsite, or the installation may not have the correct cartridges/filters for respirators, Tyvek, SCBA gear.

- Determine the 5-year incident history of the facilities identified during the assessment and assess for capability gaps.

    - Have there been any reportable accidents/incidents/releases at the specific facility? (This information can be found in the RMP report(s), by searching online, or from common knowledge – the local Fire Department, LEPC POC, Base Emergency Manager or Fire Chief may be good sources of information on this topic).
    - Is there a history of accidents/releases in the industry associated with this facility?

- Installation response plans are not up-to-date (generally require annual updates).

- Installation procedure(s) to notify personnel of an incident/emergency are lacking.

- Procedures on whether personnel should evacuate or shelter in place do not exist.

- The installation has only one evacuation route (smaller installations, especially ANG or Reserve may only have one operable gate). If this is the case, identify a secondary evacuation route for the installation in case of an incident/release that makes that gate unusable for evacuation.

Evaluate the probability associated with each scenario using the following categories and definitions:

- **3+ Gaps (Frequent and/or Likely - Likely to occur immediately or within a short period of time)**
  Identified three or more capability gaps for a scenario/release event then consider the probability Likely.
- **2 Gaps (Occasional - Probably will occur in time)**

  Identified two capability gaps for a scenario/release event then consider the probability Occasional.
- **1 Gaps (Seldom - Possible to occur in time)**

  Identified only one capability gap for a scenario/release event then consider the probability Seldom.
- **0 Gaps (Unlikely - Unlikely to occur)**
  Identified no capability gaps for a scenario/release event then consider the probability Unlikely.

Risk Level: Base the risk level for the scenario on the severity and probability results, aligned against the following ORM table.

Table 6. ORM Risk Management Table

SEVERITY (BASED ON DISTANCE TO TOXIC ENDPOINT)	PROBABILITY (BASED ON # OF CAPABILITY GAPS)			
	3+ (Frequent/Likely)	**2 (Occasional)**	**1 (Seldom)**	**0 (Unlikely)**
Catastrophic	Extremely High	High	High	Moderate
Critical	High	Moderate	Moderate	Low
Moderate	Moderate	Moderate	Low	Low
Negligible	Low	Low	Low	Low

(SECRET) Form 1-6 Risk Table

TIC/TIM No.	Facility	TIC/TIR	Severity	Probability	Risk Level